THE MIDLAND NATURALIST.

"Come forth into the light of things,
Let Nature be your teacher."
Wordsworth.

ON A RARE BRITISH ENTOMOSTRACON, *ILYOCRYPTUS SORDIDUS.**

BY H. E. FORREST, F.R.M.S.

Ilyocryptus sordidus has been found in Russia, Norway, Denmark, and Bohemia; at Dantzig, Vienna, and at Sedgefield in the county of Durham. It was found in the last-named place in 1863, and described and figured in the "Annals and Magazine of Natural History, 1863," p. 415, by the Rev. A. M. Norman.†

On the 22nd November, 1879, Mr. Bolton showed me an Entomostracon which at the time was unknown to me, but which I have since ascertained to be *Ilyocryptus sordidus.* I have to acknowledge with thanks the kind assistance of Professor A. Weismann in determining the species.

There are three known species of the genus, of which a full account has been published by W. Kurz in "Zeitschrift für wissenschaftliche Zoologie," supplement to Band xxx., 1878.

Upon referring to this work and comparing the three species there described with my specimen, I found that although there were some

REFERENCES TO PLATE I.

Fig. 1. FEMALE.
- *a* Mandible
- *b* Œsophagus
- *c* Stomach
- *d* Rectal-bladder
- *e* Rectum
- *f* Post-abdominal bristles
- *g* Post-abdomen
- *h* Abdominal hook
- *j* Heart or dorsal vessel
- *k* Antennules
- *l* Antennæ
- *m* Compound eye
- *n* Simple eye
- *o* Space in which eggs are carried
- *p* 1—5 Branchial limbs

Fig. 2. MALE, after Kurz.

* Read before the Birmingham Natural History and Microscopical Society, November 30th, 1880.

† Sedgefield, county Durham, is the only published British locality, but since writing this paper I have been favoured by Professor G. S. Brady with a list of four other places in which he has found it, and which he has kindly allowed me to publish. They are Lough Arddery, Connemara; Lough Aubwee, Connemara; pools by the side of Ennerdale Lake; and East Belsay Lake, Northumberland, (now drained.)

few points (to be noted hereafter) in which it differed from the description, there could be no doubt that it was *I. sordidus*. Mr. Bolton believes that my specimen came from a small pond in Sutton Park, near Birmingham, and that there were several more in the same water, but when I called upon him next morning there was *not one* to be seen. I had fortunately made a careful drawing of it on the previous evening, and also taken copious notes of its anatomy and peculiarities. Although I have carefully searched the pond from which it is supposed to have come, I have never found any more, and the only other specimen that I have seen is one that was accidentally preserved by another gentleman when mounting a slide of *Volvox globator* from the same locality.

It is very remarkable that my own experience of the numerical scarcity of this species has been similar to that of all previous observers except Kurz. Thus Fischer says he could find only one; Leydig also found only one; Norman found three, and subsequently one more; and in the present case only two were found. This scarcity of numbers is perhaps more apparent than real, as the animal is evidently a mud-lover, and we have all searched for it in the water instead of on the surface of the mud. Kurz, the only one who found it in any quantities, obtained it free from mud by the following ingenious contrivance:—A small net fastened in the ordinary way to a metal ring, and fixed to the end of a long string by several strands, has attached to its lower edge a large stone, and to its upper edge a piece of cork. This is flung into the water as far as the string allows and sinks to the bottom, where it stands on its edge owing to the stone and cork attached to it. As it is dragged along the stone stirs up the mud in front of it, and all the lighter particles, including entomostraca and most living organisms are swilled into the net. In this way Kurz succeeded in capturing many females of the species and a few males, the only ones ever captured. This need excite no surprise, as even in the commonest Daphniadæ males are always very rare.

The following is a description of my specimen, which is a young female, drawn on Plate I., Fig. 1:—

The shape of the valves of the carapace is oval, and they are very convex, so that the thickness of the body when viewed edgeways is so great as to make it appear almost spheroidal. Their surface is reticulated all over with polygonal, mostly hexagonal markings, which are not shown in the figure. Length from top of head to bottom of carapace 1-80″, breadth 1-100″. Colour brick red. The head is bounded by a gentle curve behind, abruptly truncate in front. There are two eyes, one compound (*m*) near the apex of the head, and one smaller simple eye (*n*) below it. The antennules (*k*) are tolerably large, and spring from the forehead just below the small eye. The antennæ (*l*) are very large and fleshy and divided into two branches, the upper one four-jointed, with three long setæ and a short spine on the terminal joint; the lower one three-jointed, the first two joints each with one seta, the terminal joint like that of the other branch. *None of these setæ are plumose.* The base of each antenna also bears two spines. Perhaps the most marked feature of the animal is the bristles with which the edges of the carapace valves are fringed. These are set in an unbroken row from just below the mandibles to the junction of the valves behind. They are flexible, rather stiff, and branched *but not plumose*, varying in length from about 1-500″ along the front of the body to about half that size along the posterior edge. The abdomen bears as usual one pair of mandibles, (*a*,) five pairs of branchial limbs, (*p*. 1—5,) and a very large post-abdomen (*g*) terminating in two long rather straight hooks. This part of the body is larger than in any other species of the family with which I am acquainted, and is capable of a very wide range of motion, at times being extended quite outside the valves of the carapace, backwards, at other times thrust upwards within the carapace till the end touches the antennules.

Along the lower edge of the post-abdomen are four rows of curved spines, two on each side of the median line, the inner rows being rather smaller than the outer. All the rows converge posteriorly and meet at the point where the two post-abdominal setæ (*f*) are situated. These last are excessively long, almost equalling the body in length, and are sparsely plumose along the distal half of their length. Posteriorly the post-abdomen is provided with a rather blunt spine, (*h*,) which serves to keep the eggs in the open space, (*o*,) where they are carried by the female until hatched. I could not make out this spine very distinctly.

The branchial legs, (Plate I., *p*. 1—5,) ten in number, are largely developed, the two lower pairs at least being expanded into great fan-like paddles. Their surface is still further increased by very long delicately-plumose setæ, which spring, apparently, from the fold of integument between the two terminal joints, and extend far beyond the edge of the paddle, often projecting as far as the ends of the setæ which fringe the carapace. Indeed, the ends of these two sets of setæ are so mixed up as to make it rather difficult to determine which are which. The intestinal canal presents no peculiarities, being almost straight. There were no ova in my specimen, and from this, its small size, and relative transparency, I concluded that it was immature.

Upon comparing the above description and figure (which were compiled from notes made while the animal was alive) with those given by Norman and Kurz, it will be seen at once that my specimen differs in two points from the "orthodox" *Ilyocryptus sordidus*; but I do not feel justified in founding a new species on grounds which, although they might fairly entitle it to rank as a variety, are only matters of detail, and require confirmation, such as can be obtained only by the examination of numerous specimens.

In the typical species, the setæ which fringe the carapace are plumose along the front or ventral edge, but along the lower or posterior edge are branched, or, as Kurz expresses it, "one-sidedly feathered," (see Fig. 2,) but in mine they are of the same character all round the carapace, (Fig. 1.) Again, in the typical species, several of the setæ of the antennæ are plumose, but in mine they are all bare bristles. These setæ, too, in mine are far longer than in the figures given by Norman and Kurz. In Fig. 1 they are cut short by the "inexorable limits of space." They should be continued in imagination about another inch, and the same remark applies to the post-abdominal setæ, (*f.*)

With regard to the first point of difference, I would suggest the possibility, from the confusion which exists among them, of the setæ belonging to the branchial feet, which *are* plumose, having been mistaken for the setæ of the carapace, which in my specimens are *not* plumose but branched.

Kurz gives the measurement of the adult as:—Female, length 1-36in., height 1-46in., breadth 1-34in.; male, length 1-61in., height 1-84in. Rather more than double the size of my specimen.

The male (Plate I. Fig. 2, after Kurz) has the head larger in proportion to the carapace than the female, and has a long bristle springing from the front surface of the antennule. Its shape is not so spheroidal as the female, for at the back, *i.e.*, along the junction of the valves, the carapace is flattened, almost concave. This, I opine, is because the male has no need for an incubating chamber, since it has no eggs to carry, and the space which in the female is provided for that purpose is, in the male, reduced to a minimum. The male was found by Kurz in August.

The name *Ilyocryptus* is derived from ἰλὺς, mud, and κρυπτὸς, hidden; *sordidus* means dirty. These epithets, though by no means complimentary, are decidedly applicable to this species, for it is an inveterate mud-lover, and is usually so covered with dirt, that it is difficult to make out its internal structure; so much so indeed that Kurz gave up in despair the attempt to delineate its branchial feet, and omits them altogether from his figures; whilst in the drawing given by Norman they are represented by a few scratches of the pen. Owing to mine being a very young and relatively transparent specimen I was more fortunate in this respect, though I could only see the fifth and fourth pairs distinctly, and must confess that the three upper pairs are drawn as I *think* they are rather than as I saw them.

The motions of *I. sordidus* in the water are very curious. It keeps up a succession of strokes with its antennæ, which, however, only raise it a short distance, and the weight of its body draws it down between each stroke exactly as far as the previous stroke raised it. So the animal is condemned to spend its whole life in a very limited area, and can never reach the surface of the water.

Is not this, perhaps, the reason why the branchial feet are so large? Their great surface must be capable of producing a very strong current between the valves; and it seems probable that in order to secure an equal amount of oxygenation to the blood, a slow moving species must have a more rapid branchial current than a more locomotive one. Therefore *Ilyocryptus sordidus* should have proportionately larger branchial feet than, say, *Daphnia pulex*. Which is the fact.

The mere mud-loving propensities of the animal are not sufficient to account for its dirty clothes. There must be something which causes the dirt to adhere. According to Norman "it is probably in consequence of these sluggish habits, and of the animal rolling itself in the mud, as well as owing to the pilose covering of the shell, that it owes the coating of mud, Diatoms," &c. The existence of the "pilose covering," of which he here speaks, is rather doubtful. On this point Kurz makes a statement which is more extraordinary than anything yet related of it, and which distinguishes it from all its fellows.

As is well-known, the Entomostraca, in common with other Crustacea, undergo periodical moultings of the outer skin, and at each moult are always rather larger than the skin which they have cast off. *Ilyocryptus sordidus*, however, does not cast off the old skin of its carapace, but wears it like an overcoat that is rather too small for it outside the new one. When it has several of these old coats on, each a little smaller than the next, it presents a "ridged" appearance like an oyster-shell. But as the edge of the carapace is fringed with branched setæ, and these persist, each ridge is also bristling, (Fig. 2.) and it is this structure that causes the dirt to adhere in such quantities.

THE ORIGIN OF MOUNTAINS.*

BY HORACE B. WOODWARD, F.G.S.

A great majority of the people, whether of this country or of any other, have never seen a mountain. Most of the larger towns and cities are placed near the mouths of rivers, or on some navigable stream, a good means of communication being an essential adjunct to growth. Mountains are situated at the heads of rivers: they are themselves their source and watershed. And the streams to which they give rise are alternately peaceful rills or furious torrents; useful as a water supply, but useless for navigation. The mountains, in fact, are barriers to traffic, and hence men do not congregate around them. Few of us, therefore, have the opportunity of often going up into the mountains; but so long as we have strayed no further than the Lake District, North Wales, or the Scottish Highlands, our minds will retain ever pleasant pictures of these, which may be counted among the grandest objects of creation. The mysterious awe which surrounds mountains has raised up many an imaginative thought. Hence, how often are they the birthplace or home of the poet and the artist, who may well be content with the comtemplation of the present features, thinking of things as they are, regarding the hills as "everlasting," and as formed, perhaps, during some mighty convulsion when the earth was in its throes, and mountains were brought forth out of chaos. But moun-

* A paper read before the Norwich Science Gossip Club, 1879.

tains suggest a variety of thoughts. While some individuals may sit quietly revelling in the glories of the scene, and moralising upon things in general, others may be stirred up to enquire more particularly into the structure of the mountain masses, desiring to know something of the origin of their form and presence. Such a process, as Professor Geikie has remarked, doubtless many a time disenchants a subject of the mystery it may have worn before, yet it never fails to raise up, in our meditative moments, feelings of far deeper wonder than it destroys.*

Instead of chaos and violence we learn of slow and gradual growth, of changing scenes and successive groups of animal life, intimately connected yet differing; and all tell of law and adaptation. We obtain glimpses of time so remote that we cannot fully realise it; when the landscape, however different from what it now is, was yet visited by rains, the impressions of whose drops are found on the hardened muds or slates of the old hills, and the coast was battered about by the wild sea-waves, as the old pebble-beds teach us. Then the forms of life, so far as we can tell, were few and inappreciative of the scenes, for the giant Trilobite (*Paradoxides*) was, perhaps, the Lord of the Creation.

We must, however, leave these fanciful scenes, and proceed more seriously to the consideration of the subject we have in hand. And at the outset of our enquiry it may not be undesirable to ask, What is a mountain? Our thoughts, perhaps, return insensibly to the days of our youth and schooling, when rigid definitions were learnt by heart. Such definitions are useful until we begin to think for ourselves, and then we see how unnatural they are. A bay or a gulf, a cape or a headland—often we cannot say which is the more appropriate term to use. And so in turning from the configuration of the land in plan, as we see it on maps, to its configuration in profile or relief, as we see it in section or in model, we cannot by actual admeasurement or by statements of height alone distinguish a mountain from a hill.

In a recently published primer of Geography, by Mr. George Grove, the following passage shows how variable is the application of the terms:—"*Mountains* (he says) are the largest eminences of a country, and *hills* the smaller ones—as we say the 'Welsh Mountains,' and the 'Surrey Hills.' But this distinction is not always kept up. The 'Mount of Olives' is a moderate-sized hill, and the 'Neilgherry Hills' are mountains more than 8,000 feet high. In India, again, the 'Hill States' are territories high up in the northern mountains, and 'going to the hills' means migrating for the hot season to Simla or Murree, which lie thousands of feet up on the spurs of the Himalayas. Sometimes, too, a collection of mountains is called a 'mount,' as Mount Lebanon, which is really a range of fifty miles long, and in some places 12,000 feet high."

If we take a general glance at our principal hills we find them to run in tolerably regular ranges or escarpments with gently flowing out-

* Mountain Architecture, 1877.

lines. Such are the Chalk Downs and the Cotteswold Hills. In these respects they differ from our mountains, which are mostly arranged in groups of partially isolated masses, rising here and there in peaks, sometimes appearing with rugged or serrated outlines, at others in rounded backs. The Pennine range, on the other hand, is an escarpment of hills, which finally culminates in the so-called mountains of Ingleboro' and Penyghent. Here we have the gradation in height from one to the other; and, indeed, if such elevated tracts were of gradual formation we must expect evidence of passage from hill to mountain. In point of structure the Pennine range is even and regular, whereas the Lake Mountains are highly disturbed; facts which sufficiently account for their different aspect. But just as mentally we distinguish between pond and lake, so may we form a general distinction between hill and mountain, in looking at the broad outlines of our scenery.

The distinctive features whether of mountains or hills are dependent upon their stony composition, the amount of disturbance to which the rocks composing them have been subjected, the geological age of these rocks (time in most cases meaning hardness,) and lastly, upon denudation or sculpture. These factors are all important, though least so is the antiquity of the rocks, which may vary very considerably.

We have spoken of the composition, structure, age, and sculpture of mountains. Into their *composition* many rocks enter, such as granite and numerous igneous rocks, slate and limestone, sandstone and conglomerate. We could not expect to see a mountain of clay, sand, or gravel, although occasional fringes of such materials may be found at different elevations; but the rocks just mentioned include hardened varieties of these. Such rocks belong to all times. Slates, limestones, sandstones, and conglomerates, originally laid down under water, in tolerably regular layers, occur in a very disturbed manner in nearly all mountain ranges that have been carefully examined. In regard to *structure*, the component rocks of mountains are generally folded and contorted, and sometimes inverted, while eruptive or igneous rocks intrude among them, and granitic rocks sometimes appear as a central nucleus that has burst through and disturbed the rocks that overlie it.

Igneous rocks, which may have existed in a molten state long previously to their eruption, are yet classified according to the geological date when they were intruded among overlying rocks; hence the central nucleus of a mountain may be much newer than the overlying rocks. The *age* of a mountain is decided by the age of the disturbance which last affected the rocks which form essential portions of its mass. Thus the mountains of Cumberland, Wales, and Scotland rank among the oldest in the world. The Wrekin, in Shropshire, is, according to the observations of Dr. Callaway, one of the very oldest in our country.

All these elevations reach a far higher antiquity than the Himalayas or Andes, because the mass of those vast ranges is composed of rocks much newer than our mountain strata. Professor

Geikie remarks that, "On the Continent of Europe, the great chains of the Alps and Pyrenees were upheaved in Tertiary times. Some of their rocks, of the same age as the London-clay, have been crystallised and hardened, turned up on end, twisted and broken so as to present very much the character of the Primary rocks of our Highlands. In America the whole backbone of the continent, from the southern end of the Andes up to the Rocky Mountains, got its chief upheaval in Tertiary times."

Some mountains received their main upheaval at one geological period, while others have been successively upheaved time after time. In the Himalayas it is said that there are indications of at least five stages of great upheaval, each of which may have been gradual. There can be no question that all mountains owe their present elevation to upheaval. Fossils have been found at heights of 11,000ft. on the Rocky Mountains, and at over 16,000ft. on the Himalayas. But since the time of their upheaval, partly, perhaps, during their upheaval, they have been worn away or denuded, so that in very few cases do we find the outlines of the mountain to correspond with the original flexures of the strata. The Jura Mountains form an exception, as their outlines do correspond to the undulations of the rocks.

Turning now to the causes which have led to such elevations, we may take it for granted that all the strata now forming the mountains were at one time at or below the sea-level. Subterranean movements have uplifted them.

Nearly all mountain ranges have been shown to be composed of strata much bent and folded, to exhibit, in fact, such a crumpling as shows a "diminution of surface area;" and it is considered by Favre that these contortions are due to the cooling of the earth, and the contraction of its radius, composed, as it is, partly of an "interior pasty or fluid nucleus." Thus lateral pressure originates, producing contortion, and the consequent elevation of certain tracts, and the depression of others. It has been stated by Prof. Duncan that a contraction of only 1-100th of the earth's circumference would have sufficed to fold the crust in a way to form all the mountains found in the meridian crossing the Alps.* Hence he considers that the land masses are upward curves on the earth's surface, the ocean floors are downward curves, looking at them in a broad way. Dana calls them "geo-synclinals" and "geo-anticlinals."

In connection with this part of the subject, it has also been pointed out by Professor Duncan, firstly, that many of the principal mountain chains are at the margins of continents, and that volcanic eruptions take place where insular conditions are being brought about, or have been brought about in recent geological times, accompanied by parallelism of the chain; secondly, that the proximity of active

* Duncan. Lecture on the Formation of the Main Land-masses.—Proc. Royal Geograph. Soc., 1878, Vol. XXII. See also O. Fisher, Geol. Magazine, Dec. 2nd, Vol. I., p. 60.

volcanoes to the sea has been attributed to the percolation of sea-water through fissures to the heated interior of the earth; and if the outlines of the continental areas are lines of weakness or fracture this is important. The instability of the margins of many coasts is indicated by raised beaches and submerged forests; in our own island especially on the western rocky and more mountainous shores.*

In addition to the movements directly produced by volcanic upheaval, it is also considered that the very material ejected from volcanoes would cause cavities that might lead to subsidence.

Then again, we know that nearly all the material worn from the land is deposited in the sea near the land, especially near the mouths of rivers. It is never carried far out to sea. And as we have mechanically formed strata several thousands of feet in thickness, such changes in the distribution of sediment may, it is thought, have some minor effects on the processes of elevation and depression.

The rude correspondence between the coast-lines of Africa and Europe on the one hand, and that of the American continent on the other, has often been the subject of suggestive remark. Dana, in commenting upon it, also upon the prevalent N.E. and N.W. courses or trends of the land, and the dependence of the outlines and feature-lines of the continents and oceanic lands upon these courses, says:—" Such lines of uplift are lines of fracture, or lines of weakest cohesion, and, therefore, like the courses of cleavage in crystals, they show by their prevalence some traces of a cleavage structure in the earth—in other words, a tendency to break into two transverse directions rather than others." This quotation shows that we have yet much to learn on the subject ere the matter becomes simple.

The sea has unquestionably formed most of the bays and headlands. But " the tapering southwards of South America has not been caused by modern denudation. The shape is the result of changes which occurred far back in time. For Patagonia, from the Andes to the east coast, is a vast pebble-bed worn out of the Andes to the west, and deposited by current and tide on their eastern flank. Upheaval has occurred on both sides of the chain during the historic period, and thus the present state of things is favouring extension rather than the diminution of the area."†

While there may have been a general sort of continuity in the direction of the main lines of upheaval and depression, the changes have manifestly been great in the physical geography of the earth in past periods. Lyell has observed that " it is not too much to say that every spot which is now dry land has been sea at some former period, and every part of the space now covered by the deepest ocean has been land."‡

* See Duncan, *Op. cit.*

† Duncan, *Op. cit.*, p. 8.

‡ " Principles of Geology," 11th ed, Vol. I., p. 260.

In Cretaceous times, as Prof. Duncan remarks, "evidently the greater part of Europe, North Africa, Arabia, Hindostan, and much of northern and eastern Asia, Australia, South America, and large tracts of North America were under water. But cretaceous land-surfaces, the edges of the deep sea, may be traced in Queensland, the Eastern Himalayas, Central Europe, and in the north-western States of America."

Indeed the present distribution of the land-masses was mainly sketched out in Tertiary times.

Our Welsh and Lake Mountains were, however, true mountains long before that period. They were depressed in the Chalk Sea, and perhaps only isolated peaks appeared above the surface of the waters, just as, no doubt, there are now old land-surfaces beneath the ocean, indicated by certain oceanic islands.

Again and again have our mountains been submerged, even, perhaps, as late as Glacial times, for on Moel Tryfaen, near Caernarvon, at a height of over 1,300ft., recent marine shells have been found that may indicate submergence to that extent. But, with all these fluctuations, the mountains have continued much as they were before, and we have no right to say that their upheaval is of Glacial or Post-glacial date, because we have vestiges of such comparatively recent deposits on their sides. Their form and structure bespeak their antiquity.

We know too little at present to write a connected history of the formation of the great mountain systems. Nor can we do more than remark upon this connection between the outlines of the great continents. When, however, we look at a diagram showing the relation of the highest mountain (29,000ft.) to the deep ocean, (we don't know its greatest depth yet,) how trivial seem the ups and downs of twenty or thirty thousand feet.

Mr. Grove compares mountains to "the heads of the nails which fasten the lead to the dome of St. Paul's." We are seldom able to realise the entire height of the mountains. The valley of the Chamouni is 3,500ft. in height; and those who ascend Snowdon usually commence at some distance above the sea-level.

Then, again, as Mr. Grove remarks, "few mountains rise at a steeper angle than 45°, and most are much less." This means an elevation of one in one. The Peak of Teneriffe, which, from the harbour, seems to be almost over your head, is said to slope only at an angle of 12°, or about one in five. The slope is, no doubt, intimately connected with the stratification or structure of the rocks, and is thus but the angle of repose.

(To be continued.)

* *Op. cit.*, p. 19.

THE FLORA OF WARWICKSHIRE.
AN ACCOUNT OF THE FLOWERING PLANTS AND FERNS OF THE COUNTY OF WARWICK.

BY JAMES E. BAGNALL.

Hitherto no complete flora of the county of Warwick has been published. In the hope of supplying this deficiency, the following notes have been compiled. These will consist of my own notes made in various parts of the county during the past fourteen years, and also of all the records of past and present observers, so far as these have been within my reach. But in availing myself of past records, some of them dating as far back as the earlier editions of Ray's works, I have not deemed it wise or needful to record those stations that are now known to be destroyed. The growth of towns, agricultural improvements, the ramifications of our great railway system, and other results of modern progress, together with the greed of collectors, have probably destroyed some of the old habitats I have ventured to quote, but as I have no certain knowledge of this, I have felt it better to give the record. A Flora which ignores the work of past botanists would not only be an incomplete but also an unjust one.

I have to acknowledge with gratitude the valuable and kindly help I have from time to time received. To Professor C. C. Babington, Mr. J. G. Baker, and the late Rev. Andrew Bloxam I am indebted for valuable assistance in the study of critical genera. To Mr. Hewett C. Watson for specimens of rare and critical plants, and also for the gift of his valuable works on Topographical Botany, from which I shall quote as occasion serves. To my old friend Henry Bromwich for many rare Warwickshire specimens, and for valuable information as to the localities of our rarer plants in South Warwick. To Mr. James Groves for his opinion on the Characeæ of the county. To the Rev. John Caswell for lists of plants observed by him about Salford Priors, and also in the neighbourhood of Oscott. To Mr. H. W. Trott, formerly a painstaking and enthusiastic member of the Rugby School Natural History Society, for many notes from the Rugby district. I am also deeply indebted to the Rev. W. W. Newbould for very ample notes from the hitherto unworked portion of the county, forming the basin of the Stour, a very inaccessible district. I have also to thank him for many valuable suggestions, and for the many kindnesses he has shown me; such as searching works I was unable to obtain, and copying for me an amount of valuable matter that has proved of great service.

Topography.

Warwickshire is the most central English county, and has a somewhat irregular form, tapering to the north and to the south.

It is bounded on the north by Derbyshire, on the north-west by Staffordshire, on the west by Worcestershire, on the south-west by Gloucestershire, on the south and south-east by Oxfordshire, on the east by Northamptonshire, and on the north-east by Leicestershire. Detached portions of the county lie in Gloucestershire and Worcestershire; no special feature in the botany, however, occurs in any of these detached portions.

Its greatest length is stated to be fifty-eight miles, its greatest breadth thirty-two miles, and it has an area of 881 square miles, or 563,946 acres.

Although beautifully undulating, the county possesses no lofty hills. The Edge Hills, forming its southern boundary, have an elevation of about 800ft. Near these are the Burton Hills, which command a fine sweep of country. South-west of the Edge Hills is Brailes Hill, and some ten or eleven miles north-east the Napton and Shuckburgh Hills. High land, commanding most extensive views, occurs at Corley, the highest point here being about 625ft. above sea level. The country about Hartshill and Oldbury is much elevated, and affords very comprehensive views over the low-lying lands of Leicestershire. Brinklow, Whitacre, and Meriden are also somewhat elevated; and near Tanworth, on the western border of the county, there is a fair sweep of highland.

The county is truly a woodland one, but boasts of no forest and but few really large woods; the most extensive ones with which I am acquainted are those of Chesterton, Oversley, Haywoods, Arbury, Merevale, Bentley, and Hartshill, but the small woods are innumerable. My experience with regard to our Warwickshire woods has been, on the whole, disappointing, as I have found them far from prolific in woodland plants.

"The New Red Sandstone prevails in Warwickshire, and occupies great part of the north-west portion of the county; its southern boundary running nearly parallel with the Avon, a few miles south-east of that river. The Permian occupies a portion of the central part of the country, and extends from a little south of Kenilworth and Stoneleigh, along the hilly district of Corley, Fillongley, and Ansley, to Baxterly. The Carboniferous system crops out on its north-east border, and forms the Warwickshire coalfield, which is about fifteen miles in length, with a varying breadth of one to five miles. The highest point of these rocks is about 500 feet above sea level. Greenstone is quarried near Hartshill, and between Nuneaton and Atherstone, Millstone Grit and an abundance of Fire-clay are found."* On the south, the New Red meets the Lias at a line drawn a few miles north of Dunchurch, through Long Itchington, to Friz Hill, a little south of Stratford-on-Avon, The course of the Lias may be traced from the neighbourhood of Edge Hills, where its upper beds of Black Shale, with bands of Blue and Grey Limestone, overlie the Marlstone. At Harbury, the lower beds are composed of Blue Clay and Shale, traversed by beds of Limestone. The total thickness of the Lias in the Midland Counties is 300ft.†

* Geography of Warwickshire, W. G. Fretton.
† Encyclopædia Britannica.

The unreclaimed land of the county is of inconsiderable extent, and the commons, once remarkably numerous, are now mostly enclosed and cultivated, or used for grazing. The most extensive heathlands are those of Sutton Coldfield, having an area of about 3,500 acres, and embracing tracts of woodland, moorland, and several large pools. Next to these are the heathlands near Coleshill, Kenilworth Heath, and Yarningale Common. In many districts, however, more especially in the northern portion of the county, the lanes and less frequented roads assume a heath-like character, and still yield a characteristic Flora.

Owing to the high state of culture in the county, bogs and marshes are of limited extent. The extensive marshlands near Hampton-in-Arden, still called Bradnock's Marsh, have been drained, and are all under cultivation. Some marshy and boggy land occurs near Coleshill Pool, and also in Sutton Park, but in both cases very limited in extent, hence marsh plants are very local, and in some cases extremely rare.

It should also be mentioned that near Leamington, Southam, and Itchington Holt, salt springs occur, yielding in the two latter places some few maritime plants, such as *Rumex maritimus*, *Juncus compressus*, *Scirpus glaucus*, and *Carex distans*.

Warwickshire, though well watered, has only two rivers of any magnitude—the Upper Avon, which is tributary to the Severn, and the Tame, which is tributary to the Trent. The other rivers of the county flow directly or indirectly into one or other of these two rivers. There is, however, an insignificant stream running south-east of the Edge Hills, which ultimately reaches the Cherwell near Banbury, and thus drains into the Thames. But, with this unimportant exception, Warwickshire forms part of the basins of those two important rivers—the Severn and the Trent.

It would have been well to divide the county into Botanical districts, by means of the various rivers intersecting it. Space, however, will not allow this. I shall, therefore, content myself with dividing the county into two large districts—the Avon basin and the Tame basin.

To render these two districts more intelligible, I will briefly describe the course of the rivers, noticing, at the same time, the country which they drain.

The Avon rises at Naseby in Northamptonshire, and enters Warwickshire near Clifton. It runs a meandering course south-west, passing some little distance north of Rugby, where it receives on its right bank the small River Swift. After leaving Rugby it runs past Lawford and Brandon, receiving on its left bank two small streams draining the surrounding country. Passing near Ryton-on-Dunsmore and Bubbenhall, it flows through Stoneleigh Park; here it receives on its right bank the River Sow. It now becomes a stream of greater magnitude, and taking its course by Ashow, passes on through the romantic grounds of Guy's Cliff, to which it lends a great enchantment. A little further on at Emscote it receives its important tributary the Leam, and passing close to the walls of Warwick's stately pile runs through Warwick Park. In this park is a pool which is fed by a confluence of streams draining the west side of the high land around Chesterton and the parish of Tachbrook. This pool appears to drain into the Avon on its left bank. From Warwick Park the Avon flows near Barford to Sherbourne, where it receives the drainage of Norton Lindsay and the country around Sherbourne. A little further on, near Hampton Lucy, it receives on its left bank Thelesford Brook, a small stream draining Lighthorne, Newbold Pacey, and Wasperton Hill. In its course through Charlecote Park it receives the small River Dene, a stream of no magnitude, having two sources, the Burton Dassett Hills and the Edge Hills, and draining much of the surrounding country, as Burton Dassett, Kineton, Butlers Marston, Pillerton, Combrook, and Wellesbourne Hastings. On leaving Charlecote the Avon flows through Alveston to Stratford-on-Avon, passing close by the church on the north-east side. Below Stratford the Avon is navigable for barges of forty tons burden through the remainder of its course.

A little below Stratford, it receives on its left bank the River Stour, and, passing Binton Bridges and Bidford, receives on its right bank the River Arrow, near Salford Priors. Near this village it also receives two small streams draining Bevington and Salford, and about a mile farther on leaves the county. Its whole course through the county is about fifty-seven miles. After leaving Warwickshire, the Avon passes into Worcestershire, through Evesham and Pershore, and enters the Severn near Tewkesbury. Its whole course is ninety-eight miles.

The Swift, a small river rising beyond Lutterworth, in Leicestershire, enters Warwickshire north of Church Over, and, passing through Cosford and Browns Over, enters the right bank of the Avon near Rugby Mill. It has a short but rapid course.

The Sow rises on the high land near Astley, and flowing near the coal district around Bedworth, through Exhall, Foleshill, Sow, Binley, and near Whitley Abbey, enters the Avon in Stoneleigh Park. It receives on its right bank streams draining Fillongley and Whitmore, namely, near Bagington Mill the small River Sherbourne, a stream rising in the high land about Corley, and receiving in its course the drainage of Allesley and Eastern Green; near Finham the Sow receives a stream draining the country around Kenilworth. On its left bank it receives several small streams draining Anstey, Sow Waste, and the high land about Brinklow and Coombe Abbey. Its whole course is about twenty miles.

(To be continued.)

OBSERVATIONS ON THE RECORD OF PHENOLOGICAL PHENOMENA.*

There are many who have shewn themselves, by their observations during the past year, willing to devote some portion of their time to the accumulation of accurate data concerning the time of occurrence of natural phenomena, and it seems to be desirable that their energies should be directed into the channel in which they will be capable of utilisation. Now before any such record as those to which we refer can be of real scientific value, certain conditions must be fulfilled, which, we are sorry to say, are not sufficiently regarded by some members of our volunteer staff of observers; and it is in the hope that they may themselves perceive this necessity that these remarks are penned.

Firstly, it is absolutely essential that the species to which the observation refers should be unmistakable; without this it is so much labour thrown away. The scientific name must be given acccurately, and, in doubtful cases, with the "authority" appended. The observer may know in what sense he himself uses the English name, but he will be a bold man if he assumes that all others use it in the same sense as he does. The possibility of misidentification sometimes exists, indeed, even with the scientific name, but it is immensely increased by the misplaced use of the "popular" name in cases like these, where there is, perhaps, no clue to what is meant except the name itself.

It is probably even more important that the scientific name should be applied to the right object. This is by no means a thing to be taken for granted; it is astonishing what mistakes will be made by really good observers. The only hope of reducing these errors to a minimum lies in subjecting the specimens, where possible, to the observation of more than one pair of eyes. This is easy to do with plants, and no records of these can be trusted which are not certified by the independent corroboration of some competent botanist. Plants have been sent for record in the "Midland Naturalist" which simply cannot and do not grow in the places to which they were assigned unless they were planted there; and one who is behind the scenes could say how often *Papaver Argemone* is mistaken for *P. Rhœas*, *Malva rotundifolia* for *M. sylvestris*, *Polygala depressa* for *P. vulgaris*, and so on. In relation to the last two, for instance, the time of beginning to flower is quite distinct, and, leaving out of question the specific distinction of the plants, it is obvious that a mixed record of the times of flowering of the two varieties can convey no useful information whatever. The same remark applies to the records of all those variable plants which have in recent times been divided into numerous "species;" and observers, who are not competent to distinguish between the forms which these species assume, will be well advised if they leave them

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* Read at the Meeting of the Birmingham Natural History and Microscopical Society, December 14th, 1880.

altogether alone. In fact, it is the most easily understood and most wide-spread species which are the most valuable for the purpose which we are now considering.

Scilla nutans and *Ranunculus Ficaria* are typical examples of the kind of plant to which the attention of amateur botanists should be directed, if only because they cease flowering during the later portion of the year. There are many plants, such as *Ranunculus repens* and *R. bulbosus*, which will go on flowering under certain conditions all the winter through, and it is easy for a superficial observer to mistake a straggler of last year for an early flower of the present. Again, misdirected zeal is often shewn in recording that certain species were in bloom on the first day of January. The primrose *(Primula vulgaris)* is a well-known example. But Flora does not make a clean sweep of her treasures at midnight on the 31st of December, to commence the new year with a botanical *tabula rasa*. The only interest, from our point of view, lies in ascertaining how soon in December the primrose opened its first flowers.

The same plant will serve also as a proof of the importance of a third requisite of utility in the observation, namely, the aspect and soil of the locality. In examining a limited district in early spring, we may hunt everywhere without finding a single expanded primrose, till we come to some favoured and well-sheltered wood, and there they may be in bloom by hundreds. We can ourselves cite an instance where a distance of only a dozen yards separated two spots, in one of which the primroses were in full flower, while in the other there was scarcely a single bud, and in the latter, indeed, no flower appeared till several weeks after. Those who were on the spot could give sufficient reasons for the difference, but the mere record of the date would have been quite misleading. The object of the enquiry is *not* to obtain the earliest period of flowering, but to accumulate data for determining the influence of climate and weather upon growth, as well as to study the *constitution* of plants, and the coincidences of occurrence of which many are well known already to country people.

For instance, there is the proverb relating to the connection between the leafing of the oak and ash, and the weather of the succeeding summer. It has not yet been proved, in our opinion, whether under similar circumstances the oak ever puts forth its leaves before the ash. Isolated instances may be observed, but these, it cannot be too often repeated, are of little value. Those observers who record that a certain plant was in flower, a certain tree in leaf, or a certain bird arrived, when they have seen only a single specimen, are retarding instead of advancing the cause of knowledge, unless they at the same time point out the slender materials on which they base the statement.

It will now be evident that useful work in this direction is not of such easy achievement as it is sometimes thought to be: it will be necessary that the observer should limit the number of objects to which his energies shall be devoted. It is intended to publish each month in the "Midland Naturalist" (with the permission of the

Meteorological Society) the list of plants, birds, and insects which they recommend for observation in the succeeding month, and a beginning is made in this number with those which may be expected to occur in January and February. The Meteorological Society undertook some years ago the guidance and collation of phenological observations, without which they would yield no result, and, with the assistance of the Rev. T. A. Preston and others, drew up a code of Instructions,* a revised edition of which is to be issued soon. While waiting for it, those observers who cannot obtain a copy of the old edition may borrow one from Mr. Preston, as he kindly informs us in a letter. From him also may be obtained any information upon the subject, and he will gladly welcome any addition to his staff of observers, especially in the more northern districts. Blank forms for the record of observations may be obtained from the Secretary of the Meteorological Society.

Finally, we will recapitulate the essential conditions of a good phenological botanical observation. It must embrace (1) the name of the object; (2) the date; (3) the exact locality; (4) the habitat; (5) the aspect and soil; (6) the elevation, at least in hilly districts; (7) any other circumstance, such as the *stage* of foliation or flowering, the number of specimens, &c., which may be necessary to place the reader in the same position as the observer for estimating the value of the observation.

"False facts in science," says Professor Jevons, in the "Principles of Science," "are more mischievous than false theories." The latter can be overthrown by the labours of other enquirers, the former may long remain a stumbling-block in the way of truth. There is distinct need of a higher code of morality among botanical observers. Those who study the progress of physical science are aware that for the most part the standard of accuracy exacted from those who pursue that branch of knowledge is very high, and that an investigator who has any regard for his reputation will publish no statement until he has checked it, and verified it to the utmost of his power. The history of English Botany is sullied with some passages which, if they do not show a direct intention to deceive, at least originated in the most culpable carelessness. Those who have the honour of science at heart should not be silent on such points, since by their utterances is formed that public opinion by which even the carelessness that stops short of dishonesty is compelled to take thought and amend its habits. In the race to be first to record a new species, a new locality, or an earlier date, it is sometimes forgotten that the only object of pursuit worthy of a man of science is the *truth*.

W. B. GROVE, B.A.
J. E. BAGNALL.

* "Instructions for the Observation of Phenological Phenomena," published by Williams and Strahan, 7, Lawrence Lane, Cheapside, London, 1875, price 6d. It is said to be out of print, but we recently obtained a copy from the publishers, so that probably a few remain.

METEOROLOGY OF THE MIDLANDS.
THE WEATHER OF NOVEMBER, 1880.

BY W. JEROME HARRISON, F.G.S.

STATION.	OBSERVER.	RAINFALL.				TEMPERATURE.			
		Total for M.	Greatest fall in 24 hours.		No. of rainy d.	Greatest ht.		Great'st cold	
		In.	In.	Date.		Deg	Date.	Deg	Date.
GLOUCESTERSHIRE.									
Cheltenham	R. Tyrer, Esq.	2·98	0·93	15	16	57·2	14	18·8	22
Stroud	S. J. Coley, Esq.	3·16	0·73	16	13	58·0	14	21·0	22
SHROPSHIRE.									
Haughton Hall, Shifnal	Rev. J. Brooke	1·87	·71	14	15	59·0	13	18·0	21
Woolstaston	Rev. E. D. Carr	2·89	·82	14	17	56·5	13	20·0	22
Leaton Vicarage, Shrewsbury	Rev. E. Pigott	2·61	1·06	14	11	58·9	15	14·5	21
More Rectory, Bishop's Castle	Rev. A. Male	2·78	·71	14	14	59·0	13	17·0	21
Larden Hall	Miss F. R. Boughton	2·71	·90	14	16				
Cardington	Rev. W. Elliot	2·59	·83	14	15				
Bishop's Castle	E. Griffiths, Esq.	2·99	·90	14	16	8·0	13	15·0	22
HEREFORDSHIRE.									
Stoke Bliss	Rev. G. E. Alexander	1·96	·55	14	17	60·0	11	23·0	20
WORCESTERSHIRE.									
Orleton, Tenbury	T. H. Davis, Esq.	2·17	·60	15	17	59·5	13	17·8	21
West Malvern	A. H. Hartland, Esq.	2·04	·62	15	15	55·0	13	19·0	21
Pedmore	E. B. Marten, Esq.	2·01	·55	14	17	59·0	13	16·0	22
Longlands, Stourbridge	J. Jeffries, Esq.	1·9[illegible]	·49	14	14	59·0	13	21·0	21
Dennis, Stourbridge	Mr. C. Webb	1·82	·45	14	14	59·0	13	18·0	21
Evesham	T. J. Slatter, Esq.	2·35	1·02	15	13	57·7	13	23·7	23
STAFFORDSHIRE.									
Beacon Stoop, Weaver Hills	C. L. Wragge	2·63	1·28	14	15	53·7	13	21·2	10
Dudley	Mr. J. Fisher	1·26	·56	14	7				
Kinver	Rev. W. H. Bolton	2·[illegible]1	·64	14	14	59·0	13	20·0	20
Walsall	Mr. N. E. Best	1·81	·41	14	17	56·0	13	18·0	22
Grammar School, Burton	C. U. Tripp, Esq.	2·01	·59	14	17	60·0	13	19·0	[illegible]3
Weston-under-Lyziard R'tory	Hon. and Rev. J. Bridgeman	1·91	·72	14	14	60·0	13	16·0	21
Wrottesley	E. Simpson, Esq.	2·04	·73	14	13	58·5	14	16·5	22
Heath House, Cheadle	J. C. Phillips, Esq.	3·61	1·[illegible]2	14	19	56·0	13	21·0	22
Alstonfield Vicarage	Rev. W. H. Purchas	4·52	1·16	14	12	55·4	13	18·0	22
Farley, near Cheadle	C. L. Wragge, Esq.	3·39	1·36	14	15	57·3	13	19·9	22
Oakamoor	E. Kettle, Esq.	3·70	1·42	14	16	60·6	13	17·9	23
Lichfield	Mr. J. P. Roberts	1·73	·49	14	15				
WARWICKSHIRE.									
Coundon, Coventry	Lieut.-Col. R. Caldicott	2·43	·83	15	15	58·0	13	19·0	21
Bickenhill Vicarage	J. Ward, Esq.	1·92	·60	14	8	52·[illegible]		21·0	
St. Mary's College, Oscott	Rev. S. J. Whitty	1·47	·39	15	13	5[illegible]·5	13	17·4	22
Henley-in-Arden	T. H. G. Newton, Esq.	2·36	·86	15	17	58·0	13 & 14	14·0	23
Rugby School	Rev. T. N. Hutchinson	1·98	·62	15	10	57·2	14	16·8	22
DERBYSHIRE.									
Stoney Middleton	Rev. U. Smith	3·65	·90	13	13	56·0	12, 13, 14	18·0	22
Fernslope, Belper	F. J. Jackson, Esq.	3·02	1·08	14	17	59·0	13	23·0	23
Spondon	J. T. Barber, Esq.	2·10	·80	14	13	55·0		19·5	21
Duffield	W. Bland, Esq.	2·92	1·34	14					
NOTTINGHAMSHIRE.									
Hodsock Priory, Worksop	H. Mellish, Esq.	2·36	·70	14	14	62·7	13	1[illegible]·8	21
Park Hill, Nottingham	H. F. Johnson, Esq.	2·08	·83	14	12	[illegible]	13		
Tuxford	J. N. Dufty, Esq.	2·60	1·03	14	17	57·0	13	18·0	20
LEICESTERSHIRE.									
Loughborough	W. Berridge, Esq.	1·92	·51	14 & 15	14	59·0	13	20·0	23
Ashby Magna	Rev. E. Willes	2·04	·72	15	1[illegible]	64·0	12	15·[illegible]	22 & 23
Kibworth	T. Macaulay, Esq.	2·03	·59	15	15	55·0	14	17·0	21
Town Museum, Leicester	M. Browne, Esq.	1·68	·47	16	15	61·0	13	13·3	22
Syston	J. Hames, jun., Esq.	1·60	·44	15	18	55·0	15	19·0	23
Waltham-le-Wold	E. Ball, Esq.	1·[illegible]0	·60	14	15	53·0	13	21·0	23
Coston Rectory, Melton	Rev. A. M. Rendell	1·57	·48	14	16	57·3	13	18·5	23
Dalby Hall	Mr. G. Jones	1·58	·53	15	12	56·0	13 & 14	16·0	22
NORTHAMPTONSHIRE.									
Towcester Brewery	J. Webb, Esq.	1·85	·56	15	12				
Kettering	J. Wallis, Esq.	2·10	·6[illegible]	15	15	58·0	14	21·0	22
Althorpe	G. S. Groom, Esq.	2·18	·71	15	12	57·0	13	17·[illegible]	21 & 22
RUTLAND.									
Uppingham	Rev. G. H. Mullins	2·10	·60	14	15	56·1	13	20·6	22
Northfields, Stamford	W. Hayes, Esq.	2·33	·78	14	12	62·0	13	19·0	22
Ventnor	J. Codley, Esq.	5·[illegible]0	2·76	18	12	57·4	25	28·2	22
Altarnun, Cornwall	Rev. J. Power	6·66	·86	16	20	59·0	12	17·0	22
Radcliffe Observatory, Oxford	E. J. Stone, Esq.	1·89	·61	16	14	57·3	14	20·9	22

CORRECTION.—For 22·0, 20th, as Oakamoor minimum for October, read 21·6, 24th.

November was remarkable for rapid and sudden changes, both of barometric pressure and of temperature. The first five or six days were cold, but from the 9th to the 14th much warmer; then came a "cold snap" from the 17th to the 24th, ice forming 2in. in thickness, and skating rendered possible at Nottingham and elsewhere. Finally the month wound up with warm pleasant weather. On the 16th the barometer fell to $28\frac{1}{2}$in., rising to $30\frac{1}{2}$in. on the 21st. Snow fell rather heavily on the 15th, and a little on the 18th and 21st. The heavy rainfall about the 14th caused floods in the Trent Valley. There was unusually little heavy fog. A very fine aurora was seen on the 3rd, at 8 p.m., and a large sun-spot was visible with the naked eye on the last two or three days of the month. At Farley, lunar halo 8th and 19th, the latter a very fine one with colours, at two A.M. Aurora on early morning of 19th. Increased activity in the sun at this time, and great changes in one of the spot regions observed with a $2\frac{3}{4}$ clear aperture.

NATURAL HISTORY NOTES BY OBSERVERS.—*Stroud.*—Small Bat seen flying on afternoon of 5th. *Shifnal.*—No Fieldfares seen yet; Throstles and Wagtails all gone; an unusual paucity of Woodcocks. *Alstonfield.*—Fieldfares first seen on 2nd, which is unusually late for them to appear. *More Rectory.*—Missel Thrush singing on 15th; Bats flying about on morning of 29th.

Correspondence.

PHENOLOGICAL OBSERVATIONS.

We call the attention of all those who intend to favour us with observations of this kind during the approaching season to the conditions enumerated in the paper by Messrs. Grove and Bagnall, which appears in this number. Every record must comply with those conditions, and be accompanied, wherever possible, and in the case of plants and most insects *always*, by one of the actual specimens observed, or by a corroboration of the name from some other competent naturalist in the neighbourhood of the observer. The Rev. T. A. Preston, The Green, Marlborough, has undertaken the collation of the results, under the auspices of the London Meteorological Society. We advise beginners to confine their attention to the species contained in the following list; but we shall be glad, in addition, to receive from those whose studies are more extensive, accounts of the occurrence of Cryptogamic species of plants, provided always that they contain certain definite information, similar in character to that demanded in the higher forms, which will enable the collator to appreciate the observation as completely as the observer himself. The following is the list of plants and insects recommended by the Meteorological Society for observation during January and February :—

JANUARY AND FEBRUARY.

Plants.

No. in List.	Average Date. Feb.		Earliest.	Latest.
70	1	*Galanthus nivalis* (Snowdrop)	Jan. 11.	Feb. 20
53	7	*Veronica hederifolia* (Ivy-leaved Speedwell)	By Jan. 1.	Feb. 20
66	8	*Corylus Avellana* (Hazel)................	Jan. 17.	Mar. 10
2	14	RANUNCULUS FICARIA (Pilewort)	Jan. 26.	Mar. 6
63	21	*Mercurialis perennis* (Dog's Mercury)	Feb. 1.	Mar. 27
6	27	*Cardamine hirsuta* (Hairy Bitter Cress) ..	Feb. 6.	April 8
37		TUSSILAGO FARFARA (Coltsfoot)	Feb. 11.	April 1

Insects and Birds.

74	*Apis mellifica* (Honey Bee)	
79	*Trichocera hiemalis* (Winter Gnat)	
88	*Alauda arvensis* (Sky-lark) song begins	} Jan.
82	*Turdus musicus* (Song Thrush) song begins	
89	*Fringilla cœlebs* (Chaffinch) song begins	} Feb.
80	*Strix aluco* (Brown Owl) hoots	

PHENOLOGICAL OBSERVATION.—*Geranium Robertianum* in full flower and good condition in old lime kiln, near foot of Beacon Stoop, on December 21st; snow on hills and fields averaging 2½ inches in depth, weather bitterly cold.—CLEMENT L. WRAGGE.

FLINT IMPLEMENTS IN THE DRIFT.—I have recently found a Palæolithic implement in gravels north of Ealing, 164ft. above ordnance datum. The spot is on an eminence, having the Thames Valley on one side and Harrow on the other. Several flakes occurred at the same place. From the high or plateau gravels overlooking Hertford I have got one good and one poorly made implement; a first-rate trimmed flake and several ordinary flakes. From the same beds, near Ware, I have a poor implement and a good slice flake; and a friend, who lives in the neighbourhood, has obtained a large ovate (broken in ancient times) flint implement from these same Ware gravels.—WORTHINGTON G. SMITH.

ORNITHOLOGICAL NOTES.—In March last, or, perhaps, rather later, a pair of Shovellers (*Anas clypeata*, Linn.) were seen on Otmoor, in this county. The male, I am sorry to say, was shot. They might possibly have bred there if undisturbed, as the place is a very suitable habitat for wild fowl. The Rev. T. W. Falcon, of Charlton, (to whom I am indebted for this information,) says :—"The Otmoor is in winter, and often all summer, a swamp of from 2,000 to 3,000 acres." He adds that the bird is sufficiently well known there (as a winter visitor) to have the local name of Spoonbill. A bird of the year was killed in the same place in October. Winter birds have arrived in fair numbers. Snipe were very plentiful early in the season, and no less than seven "Jacks" were killed in one meadow during the first fortnight in October. Three Grey Crows have been procured, (the first was, I think, on October 12th,) and seven or eight

Short-eared Owls—all in November. Fieldfares did not reach us till October 24th ; they are now very numerous in the meadows. On the 3rd inst. I observed several Grey Wagtails along the river. I have not at present heard of any Wigeon, but Teal were observed quite early in October. A green Sandpiper was seen on the Swere about the 2nd of September. Two Wheatears have been killed this autumn, on September the 23rd and October 13th respectively; this is a rare species here. Of the late immigration of Great Grey Shrikes we have thus far only had one example ; inside this bird we found the remains of a Shrew. A correspondent to the *Field*, last week, notes the occurrence of a Cormorant, at Wheatly. It was observed, during a snowstorm, (on the 23rd ult., I think,) sitting on the church spire. Dr. Plott, in his "Natural History of Oxfordshire," mentions a somewhat similar case, more than two hundred years ago. He says of this bird : "The Cormorant has been observed to come hither about harvest time, whereof there was one killed from St. Mary's steeple, (tired with a long flight,) August, 1675, and another young one taken up in Arncot field fallen down in the corn, and brought me to Oxford." I have heard of other instances which point to its habit of resting on high places. About the 3rd of this month a Shag *(Graculus cristatus)* was procured at Souldern. Mr. Wyatt, the taxidermist at Banbury, kindly let me know directly he received it, so that I was able to examine it in the flesh. We noticed on the tongue a peculiar barb-like process—doubtless of great assistance to the bird in swallowing its slippery prey. Three great spotted Woodpeckers have been shot in the neighbourhood, two of them, killed in July, were birds of the year; the other, a fine male, was procured in Broughton Park, about the end of last month. Whilst walking along the Cherwell, on the 3rd inst., a Sandpiper rose from the bank and flew up the river; I fired, and the bird fell winged in the middle of the stream. In a few seconds it righted itself and swam to the bank, up which it crept. I went a little way up the river, waded over, and returned to the place. I found the bird lying on the bank, and to all appearance dead ; I then saw that it was a fine specimen of the Green Sandpiper. However, on stooping to pick it up, the bird fluttered into the water, and immediately dived, and, although I searched till dark, I never saw it again. Col. Montagu mentions a very similar case, and remarks, "possibly it got entangled in the weeds, and was drowned ;" although this habit is, I hear, well known to those accustomed to "wader" shooting, still it may not be so to all Midland readers. I have only heard of one Merlin this season—a very fine male, procured at Gaydon, Warwickshire, early in the autumn.—Oliver V. Aplin, Bodicote, Oxon, December, 1880.

Spiders.—With warm days and clear nights during the autumn of the year, we naturally had evening mists and heavy morning dews. In my garden, two or three hours after sunrise, the cobwebs were a beautiful and curious sight. I counted 200 of them on one small shrub. The garden is less than an acre in extent, and some of the shrubs, such as currants and gooseberries, had very few cobwebs ; but I calculate that there cannot have been less than 50,000 of them in my small domain. They were of three distinct forms : (1) the exquisite lace-work of the *Epëiras*, the geometric spiders ; (2) the mass of crossed threads spun by several species of *Theridion* ; and (3) the suspended sheets of the *Linyphias*. I should estimate them at 5,000 *Epëira*, 5,000 *Theridion*, and 40,000 *Linyphia*. They stood as thick as possible on every evergreen shrub, and on every yard of hedgerow, occupying nearly every square inch of surface, yet nowhere interfering, and apparently all in peace and harmony. Every inch was the property of a separate pair of spiders, so that I found myself surrounded by at least 100,000 of these clever spinners. On the under side of a leaf, close to each web, was a little heap of *debris*—wings and heads of flies of various kinds; and one may fairly suppose that each spider would eat at least ten flies in the course of the season. We have had quite enough of flies, gnats, and midges in our garden, but if it had not been for the spiders we should have had a million more.—F. T. Mott, Birstal Hill, Leicester.

Correction.—The title of Mr. Aplin's paper, at page 287, Vol. III., (December, 1880,) should have been "The Autumn and Winter Migratory Birds *of the district around* Bodicote, Oxfordshire."

Gleanings.

Gold in a New British Locality.—Small quantities of gold have recently been detected by Mr. How, in the quartz veins of Peldar Tor, a hill in the north-west portion of Charnwood Forest, Leicestershire. These Charnwood rocks are probably *Pre-Cambrian*, belonging to the Pebidian series of Dr. Hicks.

Animals which have become Extinct in Britain within Historic Times.—The following list, by Mr. J. E. Harting, is taken from the transactions of the Herts Natural History Society:—The Bear, about 900 A.D.; Beaver, 1600; Reindeer, (Caithness,) 1100; Wild Boar, 1650; Wolf, (England,) 1500, Scotland, 1743, Ireland, 1770.

Silurian Brachiopods.—To assist Mr. Thomas Davidson, F.R.S., in the completion of his great work on Fossil Brachiopods, Mr. G. Maw, of Broseley, has washed from 15 to 20 tons of Wenlock shale, which have yielded 50,000 specimens of these remarkable fossil shells, belonging to 63 species, the commonest species being *Orthis biloba*, of which there are about 15,000 individuals of every size and age.

Work among Fossil Brachiopods.—In this year's volume of the Palæontographical Society, Mr. Davidson will publish the results of his inquiry into the fossil brachiopods contained in the quartzite pebbles of Budleigh Salterton, on the coast of Devon, giving about fifty quarto pages of letterpress and five plates. The result will be, we believe, to show that these quartzites must mainly have been derived from rocks of Silurian age in the north of France, or their former extension across the English Channel. A remarkable point is that several similar pebbles, containing the characteristic brachiopod *Orthis Budleighensis*, have been found in the Midlands during the last year or two, by Mr. Harrison, near Leicester, Mr. Jennings, at Nottingham, and others in the vicinity of Birmingham. Here is some winter work for local geologists! Let them crack some thousands of the common liver-coloured or pale pebbles—petrified kidneys as they are commonly called—and they will almost certainly come across some evidences of life which may enable us to trace more certainly these rocks to their source at all events they will keep themselves warm!

Reports of Societies.

BIRMINGHAM NATURAL HISTORY AND MICROSCOPICAL SOCIETY.—GEOLOGICAL SECTION.—November 23rd. It was announced that on and after the 24th of November, the Society's room in Mason's College would be open to members from twelve to three daily. Mr. T. H. Waller, B.A., B.Sc., read a paper on "Igneous Rocks," detailing their origin and general characters, their mineral constitution, and the decompositions to which they have been subject. At the close of his paper, Mr. Waller exhibited by lantern some photographs of rock sections, illustrating some of the chief characteristics of the principal rock-forming minerals and also some peculiarities of rock structure.—GENERAL MEETING.—November 30th. Mr. Herbert Spencer was elected a hon. vice-president of the society. Mr. W. H. Wilkinson exhibited *Pisidium cinereum*, *Planorbis vortex*, *Limnæus pereger*, freshwater mollusca from this neighbourhood, and read some notes on the development of the last-named species. Mr. H. E. Forrest read a paper on "A Rare British Entomostracon, *Ilyocryptus sordidus*," which appears in this number.—GENERAL MEETING.—December 7th. Mr. H. J. Carter, F.R.S., presented to the society, through Mr. Hughes, copies of thirty-four papers which he had at various times contributed to the Annals and Magazine of Natural History. Mr. J. E. Bagnall exhibited reticulated vessels from the rootlets of the Leek, and laticiferous vessels from the stipules of *Ficus elastica.* Mr. Lawson Tait exhibited the metacarpal bones from the hand of a horse, showing how the rudimentary bones of the ring and index-fingers had been united to the central bone by an osseous deposit, the result of inflammation, which union always produces lameness in the horse. Mr. C. Pumphrey then read a paper on "Molluscan Palates, and the mode of obtaining them." He pointed out the positions in which they occur in different species, and the mode of dissecting them out; their preparation by boiling in caustic potash, and the mode of mounting them, either dry or in Canada balsam. He also exhibited numerous specimens under the microscope.—BIOLOGICAL SECTION.—December 14th. Mr. J. Morley exhibited, under the microscope, scale of sole, to show the effect of polarised light. Mr. Robt. W. Chase exhibited the Shore Lark and Lapland Bunting, both taken near Brighton. Mr. Blatch exhibited *Ocyusa picina*, a very rare beetle, from Sutton Coldfield, new to the district. Mr. J. Levick exhibited, under the microscope, a minute organism of a pink colour, which he believed to be a species of Volvocineæ. Mr. J. Bagnall exhibited sections of *Marchantia polymorpha* and sections of leaf of Begonia, and read some notes describing peculiarities of structure in these plants. Mr. W. B. Grove, B.A., read a paper containing "Observations on the Record of Phenological Phenomena." MICROSCOPICAL GENERAL MEETING.—December 21st. Mr. Blatch exhibited *Chirocephalus diaphanus*, "The Fairy Shrimp," from Knowle, believed to be new to the district. Mr. W. B. Grove, B.A., exhibited on behalf of Mr. G. T. Harris, a moss, *Thamnium alopecurum*, from Ewias Harold, Herefordshire. The Chairman announced that from this date the sub-curator would be empowered to issue and receive the books of the Society's library during the hours from twelve to three daily. Mr. W. H. Wilkinson then read a paper on the "Flora of Bournemouth," which he illustrated by about fifty mounted specimens. The rarer plants were: *Ranunculus tripartitus, Drosera intermedia, Claytonia perfoliata, Chicorium Intybus, Erica ciliaris, Erythræa littoralis, Cicendia filiformis, Gentiana Pneumonanthe, Cuscuta Europœa, Pinguicula lusitanica, Agrostis setacea, Osmunda regalis.* He recommended Bournemouth as an excellent centre for a botanical excursion, floras of the most diverse character being found within easy reach of the town, as at Poole Harbour, Swanage, Lulworth, Alum Bay, and the New Forest.

CHELTENHAM NATURAL SCIENCE SOCIETY.—November 18th. Rev. J. D. Breen read a paper on "The Theory of the Descent of Man One Hundred Years Ago." The paper gave a carefully-digested account of Lord Monboddo's opinions on the descent of man, and pointed out how far they agree with, and in what respects they differ from, those of Mr. Darwin. An interesting discussion followed. Colonel Basevi afterwards exhibited some living organisms under the microscope.

OXFORDSHIRE NATURAL HISTORY SOCIETY.—A meeting was held in the Lecture Room of the Botanic Gardens, on the 4th Dec., Professor Lawson in the chair. The rules were revised and passed, the subscription being fixed at 5s. per annum till the Society begins publishing a journal, and it was also arranged to have a field day once a month, and a monthly meeting for the comparison of specimens and reading short papers, &c. Professor Westwood, F.R.S., was unanimously elected president, the other officers being Professor Lawson, President of the Botanical Section; Professor Westwood, Entomological; Mr. E. B. Poulton, Geological; Mr. Oliver Aplin, Ornithological; Mr. H. Boswell, Biological; Mr. G. C. Druce, Secretary and Treasurer. After the meeting Mr. Oliver Aplin exhibited eggs of the Iceland Falcon *(Falco Islandicus)* and the great Northern Diver *(Colymbus glacialis)* from Iceland; the Little Auk *(Alca alle)* from Davis's Strait; the Manx Shearwater from the Faroes; the Noddy Tern, from Ascension Island. Professor Lawson exhibited and described a peculiar unicellular alga *(Dictyodon,)* and Mr. Druce showed *Isoetes Mooreii*, from Lough Bray, County Wicklow, recently discovered there by Mr. A. Moore, of Glasnevin; *Cystopteris montana*, found this year on Helvellyn, by Mr. Bolton King; *Chara fragifera*, found in the Scilly Isles and Penzance, from the discoverer Dr. Ralfs; and *Chara stelligera*, from Felby Broad, Norfolk.—On Tuesday, November 9th, Mr. E. B. Poulton gave a lecture on the "Geology of Shotover Hill," which proved extremely interesting. The formation passed over after leaving Magdalen Bridge would be alluvial, deposited over beds of gravel, in which might be found bones of the deer, sheep, and elk, beneath this being a much older gravel, containing bones of the rhinoceros, elephant, and hippopotamus. From St. Clement's to the rise of Headington Hill, the Oxford clay would be passed over, the more abrupt ascent marking the appearance of the coralline limestone, underneath which was a shallow layer of sand, both the limestone and sand containing fossils. After getting to the top of the more abrupt ascent, undulating country would be passed over, marking another deposit of clay called Kimmeridge clay. Capped by this at the steepest rise of the hill came the Portland sand, a sand containing large masses of limestone, while above this, and forming the apex of Shotover, was a formation once classed with the greensand, but which, from the recent discoveries of a certain small crustacean, the lecturer considered to be a fresh water deposit, probably of the Wealden formation. Mr. Poulton concluded his lecture by describing the formation of oolitic limestone, of ochre, and the clay. The lecture was especially intended to illustrate and describe the portion of the hill to be inspected on the next field day. After the lecture Professor Lawson exhibited, under microscopes, sections of oolitic limestone, agates, *Eozoön canadense*, and Foraminifera and Polycystina.

PETERBOROUGH NATURAL HISTORY AND ARCHÆOLOGICAL SOCIETY.—November 18th.—The Rev. J. G. Wood lectured on "Ants" in his usual interesting manner, and illustrated his remarks by numerous explanatory drawings. December 1st.—Mr. J. C. Buckmaster (of the Science and Art Department, South Kensington) delivered a lecture on "The Application of Scientific Principles to Agriculture," in the course of which he explained what was being done in that respect by the Science and Art Department by the establishment of evening classes in various parts of the country under the care of qualified teachers. His hope for the future of agriculture in this country, he said, depended on the better education of those engaged in it, and these classes were already doing great good among those who would be the farmers of the future. December 6th.—Mr. T. C. Hepworth gave a lecture on "The Electric Light," and exhibited a number of interesting experiments illustrative of his subject.

1

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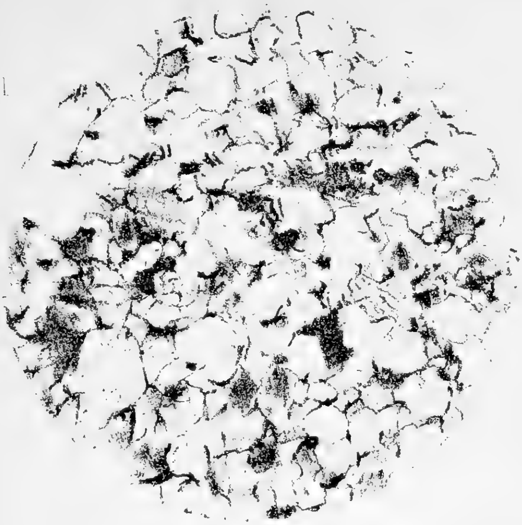
2 inch.

PENNANT GRIT.

Plate III.

1.



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MILLSTONE GRIT

ON THE GRITS AND SO-CALLED SANDSTONES OF THE LOWER AND MIDDLE SERIES OF THE BRISTOL COALFIELD.

BY EDWARD WETHERED, F.G.S., F.C.S.

The Bristol Coalfield may be said to be noted for its series of Grits and so-called Sandstones. These certainly have their equivalents in the South Wales, Somersetshire, and Forest of Dean Coalfields; and possibly, if they could be distinguished, in other districts also. They serve as stratigraphical land-marks, but owing to the difficulty in distinguishing one from another, serious mistakes have arisen.

The object of the present paper is (1) to compare these sandstones with one another, with a view of ascertaining whether there are distinguishing features; (2) to gain a more accurate account of the general chemical composition;* and (3) to note the changes which occur when they are in contact with carbonaceous matter. Their relative positions will be seen on reference to the attached section of the coalfield on page 26.

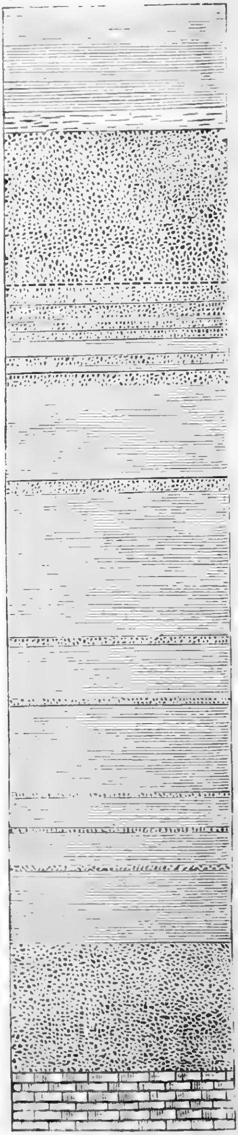
First, I desire to draw attention to the application of terms grit and sandstone. Rutley, in his "Study of the Rocks,"† gives the following definition :—"These, when indurated, constitute sandstone, and when more or less coarse grained and composed of angular and sub-angular grains of sand are termed grits." In the first place, if angularity is to define a grit, the term sandstone, as applied to beds of the Carboniferous period, appears to me to be an error, as in every case which I have examined angularity has occurred.‡ This feature is well shown in the microscopic sections of the Pennant grit which are given, and in those of the Millstone grit (see Plates II. and III.;) but in all that I have examined the grains of the latter show the least angularity, and it is consequently least entitled to be called grit, according to our present understanding of the term. It is plain, therefore, that if angularity is to be considered in the matter, grit must be more extensively applied to Carboniferous arenaceous rocks than has been the case hitherto. Then as to coarseness: if that is to be a guide to the application of the term grit, endless confusion will be caused owing to the great variation in one and the same deposit. In the Millstone grit, for instance, and in that of the Pennant, (see microscopic sections,) there is considerable variation, one bed is fine, and another, a few feet apart, is coarse; the two Pennant specimens were taken from the same quarry. It therefore suggests itself to me that it would be well to confine the term grit to those rocks the grains of which are angular or sub-angular; and to apply the term sandstone where the grains of the rock are not angular, *i.e.*, where the sharp edges have been worn off.

* And these, I take it, may be considered as typical of arenaceous Carboniferous rock generally.

† Page 17.

‡ Mr. Sorby was the first to draw attention to this fact in his address to the Geological Society of this year; but my observations were made quite apart from his. I now, however, wish to bring them forward only as a confirmation.

SECTION OF THE BRISTOL COALFIELD, SHOWING POSITION OF THE CHIEF DEPOSITS OF GRIT.



		THICKNESS OF BEDS. FEET.	DEPTH IN SECTION. FEET.	STRATA.	PER CENT. OF SILICA.
UPPER SERIES.					
MIDDLE SERIES.	Argillaceous Bed ..	..	..		82·66
	Pennant	970			89·13 to 84·9
			1,837		90·70
	Francomb Stone ..	66	1,903		72·8
	Millgrit Stone	6	1,927		89·0
	Rag Stone	60	1,994		
	Black Vein Stone ..	18	2,162		97·33
	Parrot Stone	120	2,322		
LOWER SERIES.	Holmes Rock	45	2,[illegible]64		94·88
	Doxall Stone	18	3,850		84·56
	Hard Venture Stone..	45	5,480		94·3
	End of Coal-Measures	..	5,754		
	Millstone Grit	800	..		91·1 to 98·5
	Carboniferous Limestone..	..	..		

I now propose to begin with the Millstone grit, which lies at the base of the coal measures, and take in ascending order the chief deposits of stone in the coalfield for examination.

Of the Millstone grit five specimens were selected from Brandon Hill; the following are the analyses :—

BRANDON.

	Hill No. 1.	Hill No. 2.	Hill No. 3.	Hill No. 4.	Hill No. 5.
Silica	97·40	98·36	98·56	97·13	97·60
Alumina	·70	·70	·33	..	·20
Iron	·86	·46	·53	..	1·36
Lime	·76	·45	·10	..	·46
Carbonaceous matter	·20		·15	..	
Carbonic acid		·23	·25	..	·70
Water	·30	·20	·20	..	·20
	100·22	100·40	100·12		100·52

DETAILED ANALYSIS OF BRANDON HILL NO. 3.

	Soluble in Acid.	Insoluble in Acid.	Total.
Silica			98·56
Alumina	·33		·33
Iron	·20	·33	·53
Lime	·10	..	·10
Carbonaceous matter	..	..	·15
Carbonic acid	..	..	·25
Water	..	..	·20
			100·12

We gather from the detailed analysis that the alumina and lime exist in a soluble form, but most of the iron is quite insoluble in strong acid. We may, therefore, conclude that it is in combination with silica.

The analysis has shown that the grit contains 97·54 of silica, taking the average of the five analyses; and the microscopic sections show that the grains exist in sub-angular form. The question may be asked to what is the compactness of the rock due? My late friend, Mr. Stoddart, F.G.S.,* of Bristol, considered that the grains were "agglomerated with oxide of iron." The available quantity of iron present, however, is small, (that which is soluble in acid,) and even if the alumina and lime acted in the same capacity there would only be 0·63 per cent. of cementing matrix; and it seems almost impossible that so hard a rock could be cemented together, as it were, with so small a portion. It is, of course, possible that these ingredients may, to a degree, so act; but I am nevertheless persuaded, that not only in the Millstone grit, but in

* Proceedings of the Bristol Naturalists' Society, Vol. I., Part 3, new series, p. 337.

Carboniferous arenaceous rocks generally, the particles of silica cement themselves together, possibly by the cohesion of the particles assisted by long continued pressure.

The origin of the word Millstone grit is due to the rock having been used for millstones, but it is also known in other parts of England as the "Farewell" rock, as being the base of the coal measures. When it is met with the miners know that they have come to the end of productive coal-bearing strata.

Now, grave errors have arisen in determining this rock, others higher up in the series of coal-bearing strata, having been mistaken for it. For instance, the "Black Vein" grit of the middle series is, so far as chemical composition and lithological features are concerned, a Millstone grit,* putting aside, of course, the question of thickness. This will be shown by the following analysis :—

ANALYSIS OF THE BLACK VEIN STONE.

Silica	97·33
Alumina	·96
Iron	·50
Lime	·40
Carbonaceous Matter	·45
Carbonic Acid	·60
Water	·15
	100·39

The next development of grit above the Millstone grit in the Lower Coal measures is locally known as the "Hard Venture."

Two beds of typical stone, ten feet apart, gave the following analysis :—

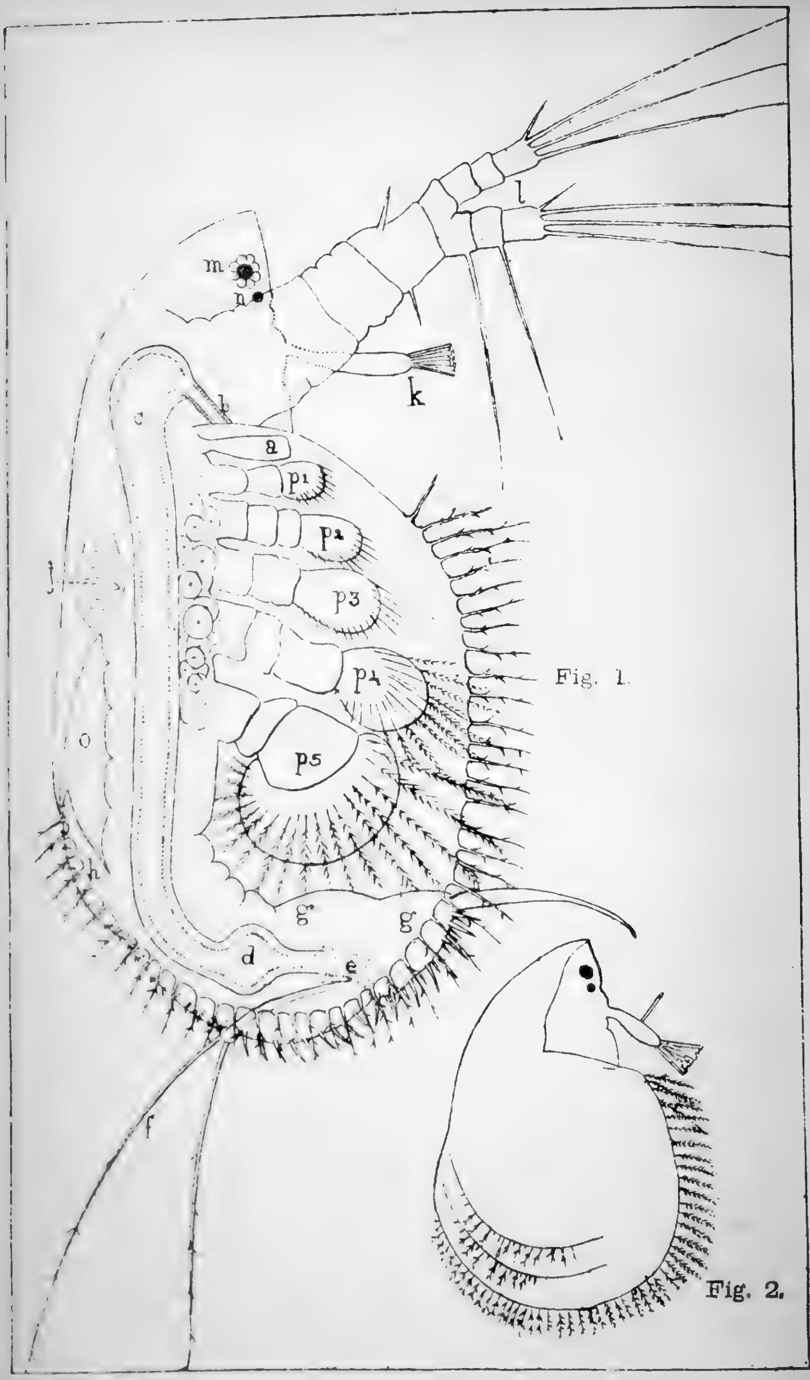
ANALYSIS OF THE "HARD VENTURE" GRIT.

	No. 1.	No. 2.
Silica	94·30	94·33
Alumina	3·63	3·70
Iron	·43	·30
Lime	·50	·60
Carbonaceous Matter	·80	1·00
Carbonic Acid	·30	·20
Water	·20	·40
	100·16	100·53

DETAILED ANALYSIS.

	Soluble in Acid.	Insoluble in Acid.	Total.
Silica			94·33
Alumina	·23	3·47	3·70
Iron	·30		·30
Lime	·33	·26	·60
Carbonaceous Matter	..	..	1·00
Carbonic acid	..	..	·20
Water	..	..	·40
			100·53

* The only difference which can be relied upon is, that the Millstone grit has usually a light pink tinge.



H. E. Forrest, del.

Ilyocryptus sordidus.

Both beds give practically the same amount of silica. Silicate of iron is absent, the whole of the iron existing as an oxide or carbonate. The greater portion of the alumina is combined as a silicate, and a portion of the lime also. The colour of the stone is grey, and it is full of black specks of carbon. The exact thickness of the deposit I am unable to give, but it will probably be about forty or fifty feet.

The next deposit of rock to which I desire to direct attention is that of the Doxall grit, which, however, is only about twelve feet thick.

The name "Doxall" is derived from a seam of coal of that name upon which the grit rests. In the great majority of cases, indeed almost always, seams of coal are followed for a few feet by beds of shale and other semi-argillaceous beds, known in the mining districts of the south-west of England as "Duns." In the present case these are absent, the grit resting on the coal. I wish, however, to draw special attention to the difference in the composition of that close over the coal and that which is not.

ANALYSIS OF THE DOXALL GRIT NO. 1.—STONE NOT CLOSE OVER COAL.

	Soluble in Acid.	Insoluble in Acid.	Total.
Silica			84·56
Alumina	1·86	3·64	5·50
Iron	2·36	·74	3·10
Lime	..	..	1·73
Carbon	..	..	2·60
Carbonic Acid	..	..	1·90
Magnesia	..	..	.04
Water	..	..	·60
			100·03

NO. 2.—STONE CLOSE OVER COAL.

	Soluble in Acid.	Insoluble in Acid.	Total.
Silica			75·[illegible]5
Alumina	2·20	6·36	8·56
Iron	5·53	..	5·53
Lime	·70	..	·70
Carbon	..	..	8·05
Carbonic Acid	..	..	·33
Magnesia	..	..	Trace.
Manganese	..	..	·26
Phosphorus	..	..	Not estimated.
Sulphur	..	..	·74
Water	..	..	·60
			100·32

A comparison of these analyses shows that in the case of the stone which rests upon the coal the proportion of alumina has increased, in other words, it has become more argillaceous. Also, we find manganese, phosphorus, and sulphur present. Having called attention to this change in the chemical composition of the stone, I will pass on to review the other deposits of grit, and revert to it again presently.

(*To be continued.*)

THE ORIGIN OF MOUNTAINS.

BY HORACE B. WOODWARD, F.G.S.

(Continued from page 10.)

This leads us on to the question of *Sculpture*. In the case of the Jura Mountains we may learn how the disturbance of the strata has directly produced the heights, the summits of the folds corresponding with the elevations; but in nearly all the great mountain chains, and, indeed, in nearly every hill and dale in this country, we find that the features are the result of the excavation or denudation of the rocks; the valleys are due to the removal of material.

Elevatory forces must in all cases have brought the rocks to their present height; still we find our very highest hills and mountains are but wrecks of heights that once towered much above them. Nor can we wonder that time has brought change. If we glance at the "Shivering Mountain" (Mam Tor) in Derbyshire, we learn that every rain and frost brings down much earth and rock. In the same way severe winters play havoc with newly-built walls, embankments, and railway cuttings. In the Lake District the driver of the coach will tell how there have been "rushes of stones" here and there. The great Bowder Stone, in Borrowdale, is a witness to this; and the "screes" or masses of loose material that here and there form the slopes up which the pedestrian has to climb, testify to the destruction that goes on. Nor have the waterfalls been idle. If we could see them in the winter time, or after heavy rains, we should not be disappointed with them. Imagination must in fine weather come to our assistance in picturing the Scale Force to be "The Queen of Waterfalls;" we may, perhaps, acknowledge the "Stock Ghyll" to be "the gem of the Lake District;" but when we come to Lodore, and are told that it is "The English Niagara," the imagination requires a considerable stretch.

But, setting aside what each stream and torrent is doing, leaving out the results of the winter's frost, we know very well that some time ago, two or three hundred thousand years, more or less, the hills were clad in snow and ice, glaciers formed in the valleys and clefts, and then the hills suffered much denudation. The wreck of older rocks, in the form of boulder clays, spread over the Eastern Counties, speaks forcibly of this great destruction.

All mountains have thus suffered great denudation at different periods of their existence, yielding up their materials to furnish records of later ages. Their outline is owing partly to the durability of the rocks, partly to the lie of the strata.

One other form ought to be mentioned, the "burning mountain," or volcano, which is built of the material ejected, and attains a height—in the case of Kilauea, in Hawaii, of nearly 14,000 feet.

As it is considered that volcanic action was in former times more potent than it now is, every outburst being a loss of energy, so in past times the movements of the earth's crust must have been greater in extent and rapidity than they now are.

In conclusion I would add a few reflections which a trip from Norwich to the Lake Mountains afforded in the summer of 1878. To one whose time is mainly devoted to geological questions a holiday trip should be a change, not only of scene and air, but of work. And I must confess to feeling little inclined for minute observations, caring not much whether a rock of quartz-trachyte came up here or a *Tetragrapsus* was found there. It was sufficient to know, from the laborious observations of others, that the mountains told a tale of gradual formation; that the slates of Skiddaw, the oldest rocks in the district, were at one time the soft muds of a primeval ocean, in which traces of life then occurred in the shape of mollusca (brachiopoda) and crustacea (trilobites,) with tracks of worms and ripple marks; how succeeding the deposit of ten thousand feet of these materials volcanic action became intense; and that in the green slates of Borrowdale (of which many of the houses are chiefly built) we have at first submarine volcanic deposits, then ashes and lava-flows ejected on land. The late Mr. Clifton Ward has told us that the boss of Castle Head, Keswick, was probably the original centre of intense volcanic action, the stump, in fact, of an old volcano. Some twelve thousand feet of this Borrowdale series remain to tell the tale, and being differently acted upon by the weather from the Skiddaw slates, they form the rough hills in Borrowdale and near Grasmere, distinct from the smoother outlines of the more truly slaty hills of Skiddaw.

These rocks were upheaved and considerably denuded before the succeeding Silurian rocks of Coniston and Windermere were laid down, comprising fourteen thousand feet more of strata. And these beds were subsequently rolled and disturbed so as to form a mountain group as early as Carboniferous times, before our coal was formed. Thence and in succeeding periods they have been up and down, but not to any great extent disturbed. The conformation of the strata has remained much as it is now, but the various agents of denudation, sea, rain, and rivers have at intervals laboured in carving out the main features now represented, while in the "Great Ice Age," not only was much denudation effected, but many scattered boulders were distributed over the surface, which here and there was scored or smoothed by the passage of the ice and its embedded stones.

In remembering the old volcanic eruptions of Keswick, we must bear in mind that even the volcanic deposits themselves have been disturbed, bent, and fractured.

Snowdon, too, is composed partly of aqueous and partly of igneous rocks crumpled together, out of which the present mountain has been carved, with no direct reference to the volcanic features that formerly affected the area. In the Alps, too, according to Professor Heim, all the eruptive rocks are much older than the elevation of the chain, which proves that they have merely played a passive part, like the sedimentary rocks themselves, during the elevation.*

* Geol. Mag., Dec. 2, vol. vi., p. 131.

The journey from the Lake District to the Eastern Counties brings with it thoughts of the present; we return as it were from the remote past to causes now in action, and in reality as much as in thought. For in crossing the country to Norfolk we pass over the principal geological formations in ascending order. And if we but keep our eyes open, the varying features of the country are seen to be in accordance with the changing rock structure that is now and again exhibited in the cuttings through which we pass.

Travelling by the London and North-Western Railway from Keswick and Penrith to Tebay and Ingleton, we pass through a grand country of hills and mountains, and of rapid streams, whose beds are strewn with boulders, some no doubt formed by the rush of waters, others derived from the boulder clay which here and there mantles the older rocks. How glorious is the country between Tebay and Ingleton, mostly in Westmoreland! The long range of Carboniferous rocks forming the Pennine chain lies to the east, the more diversified eminences of Silurian and older rocks occur on the west.

At Ingleton we come upon the limestone rocks of the Carboniferous age, (the Mountain or scar limestone,) and we can trace it by the bare scarped faces seen here and there, first on one side of the railway and then on the other. Higher rocks of the Carboniferous group cap Ingleboro', which is an outlier of tolerably even stratification. Then by Settle and Skipton to Leeds, on the Midland Railway, we pass through the Yorkshire dales composed of these same rocks, some of which, in the Millstone grit and Coal Measures, yield famous building and paving stones, which have been used all over the country. One is struck with the numerous large towns, many little known to residents in the Eastern Counties, centres of manufacturing or mining industry, all well built of stone.

At Leeds, we are on the true Coal Measures, a group of shales, building stones, and seams of coal. A very grimy district it is, though once a beautiful country of well-wooded vales, now the prey to smoke from the numerous engines and blast furnaces. We may note many quarries and cuttings in the grit rocks, and we may discern, too, many a coal-seam exposed in the railway cuttings. Such seams it would not pay to work at the surface, partly on account of the great amount of waste material to be removed, partly because coal is apt to deteriorate near the surface.

From Leeds to close upon Derby we pass over the Coal Measures, and then enter upon the open vale of New Red Rocks, a low-lying undulating tract of pasture land. Near Syston, these Red Rocks contain masses of gypsum. We have left the country of stone walls, and have come into that of hedges, while bricks and tiles as a rule replace the stones and slates of the buildings.

From Leicester to Melton Mowbray we cross the Rhætic Beds and Lias, the former seen near Barrow-on-Soar, where also the nodular limestones of the Lias are worked for cement.

Westward we have a peep of the tiny mountain group of Charnwood Forest, with its slaty rocks and syenitic granites at Mount Sorrel. Brickyards and pasture land characterise much of the Lias.

And then we enter upon the Oolites at Ketton and Stamford, where the fine yellow freestone again gives a feature to the country in more hilly ground, forming often a rich agricultural land, marked by occasional stone walls, while the churches and houses testify to its use as a building material. From Peterborough to Brandon, we have little to diversify the scenery, for a monotonous level of fenland is crossed. The works of man in draining and top-dressing have resulted in good crops of corn; but much of the land is still moory, as the black banks of the numerous ditches tell us. Brandon shows us sections of the Chalk, and thence this is mostly obscured by coverings of drift gravel and boulder clay, until we reach the city of Norwich, with its cliffs of Chalk and Crag and Glacial beds.

Hence we have traversed the Cambrian, Silurian, Carboniferous, New Red, Lias, Oolitic, Cretaceous, Later Tertiary, and Quaternary deposits.

From the old to the new, from the hard to the soft, we hav passed stage by stage; and from the elevated tracts of the Lake District, we have come to the levels of the Fenland and the alluvial marshes of the Yare. From some of the earliest records of geological history we reach the causes now in action and the deposits of our existing rivers, and they insensibly lead us to the sea, where much of the sediment they denude is outspread.

A consideration of all the facts we have noticed suggests the idea that our present oceanic deposits are perhaps the first stages of some future mountain group, and we attempt to carry on the chain of thought in the future as we can trace it back roughly in the past.

Insignificant as may be our mountains when compared in height with others that reach nearly ten times their elevation, there is, nevertheless, no tract in the world which can boast greater diversity of surface in a similar area than our own country. And I think most of us feel that each kind of scenery has its own peculiar charm.

It may sometimes happen that descriptions of the scenery of tracts with which we are very familiar appear to us too highly coloured—while, on the other hand, a visit to a new district often conveys an exaggerated sense of its beauty or grandeur, which may disappear as we familiarise ourselves with the country.

Thus our Norfolk cliffs have been described as "dreadful heights," as "stupendous and amazing precipices," as a "long chain of mountainous cliffs;" and I remember reading in the tour of a foreigner in England such a description of the scenery viewed from a hill in Essex, about 300 feet in height, as I should hesitate to apply to a Devonshire landscape. As I have heard a friend say, it was a scene where no mountains obstructed the view! My first impressions of the Malvern Hills (which is a tiny and geologically very ancient mountain range) far exceeded my expectations as I stretched out of the window of the railway carriage to catch a glimpse of their summits. And I was equally impressed with the panorama of mountains seen from Keswick, which exceeded in grandeur all the notions I had gathered from books and pictures.

Much might be said about the uses of mountains. Their influence on climate is well known. We are aware how we can pass from tropical to arctic regions as well in ascending the Himalayas as in going from their base towards the poles.

And it is a very interesting question to compare the plants and animals distributed over the superficial zones with those occurring in zones of altitude, and to trace out the various influences which have led to their present distribution, when under existing conditions no means of migration may exist.

The temperature decreases 1° for about every 350ft. in elevation, for the atmosphere less dense is less capable of retaining heat. It is warmed chiefly by the earth, the lower strata of the atmosphere being heated by direct contact with the earth, the higher only by radiation. Moreover, "as the air expands under the diminution of pressure in the higher regions, it absorbs sensible heat to maintain the expansion of its own substance, and renders that latent and insensible. The air itself thus becomes cold, in consequence of its warmth being taken away from it for use in a different way." *

The snow line in tropical regions varies from 15,000 to 20,000 feet above the sea. Mountains are great condensers, hence the great rainfall in hilly regions. In the Khasia Hills, behind the Bay of Bengal, hot moist winds from the Indian Ocean create an annual rainfall of 50ft.; it is the rainiest district in the world. In the Lake District we have in some parts an annual fall of from 15ft. to 18ft., while away from the mountains it sinks even on the same coast to sometimes only 2½ft.

Mr. Grove observes that "We in Europe can form little idea of what a frightful calamity the want of mountains and streams is. Australia will probably suffer from it to the end of time. Had that great continent been divided by a range of mountains, sufficiently lofty to have had perpetual snow, and thus to intercept the hot winds and rob them of their moisture, it would have been one of the richest countries in the world; and its interior, instead of being, as much of it is, a wilderness of countless sand ridges, itself devoured by scorching winds, and the source of drought and oppression to the settlements on the coast, would have been one giant field of corn and pasture."

He remarks also that "mountains have played a great part in the history of many countries by affording a refuge for the people when the lowlands were conquered, and preserving for long the names, manners, and customs of the first inhabitants of the country. There, far away from cities and communication with the rest of the world, they preserve the simple virtues of primeval life, though they also preserve its ignorance and prejudice."

* R. J. Mann, in "Modern Meteorology," 1879, p. 22.

We ought, indeed, to be thankful for our mountains: they are fittingly the recreation-ground of the hard-worked citizen, and long may they remain so; although alas! the hand of man is fain to break the charm of the scene by introducing railways, and to modify the natural beauties of a lake by turning it into a Manchester reservoir. This may be a kind of evolution: it is, however, more pleasing to contemplate the natural evolution of the mountain, from the soft muds of an ocean and the ashes of a volcano, through many changing scenes in the earth's history, and to think that all it may teach, and the influence for good its scenery may impart, were intended for the benefit of man.

THE FLORA OF WARWICKSHIRE.
AN ACCOUNT OF THE FLOWERING PLANTS AND FERNS OF THE COUNTY OF WARWICK.

BY JAMES E. BAGNALL.

(Continued from page 14.)

The Leam rises on Marston Hill, and flowing for a few miles in Northamptonshire, re-enters the county near Wolfhamcote, and takes a westerly course, flowing by Grandborough, Birdingbury, and Marton, near which it receives on its left bank the River Itchin. From here the Leam flows on near Wappenbury, Offchurch, Radford Semele, and through Leamington Priors to Emscote, where it joins the Avon. Its whole course is a somewhat tortuous one of thirty miles.

The Leam receives on its right and left banks several streams. On its right bank those draining Dunchurch, Draycote, Bourton, Frankton, and Cubbington; on its left bank the streams rising in the high land about Shuckburgh, and near Marton the river Itchin, which rises in the high land near Fenny Compton, and takes a northerly course through Bishop's Itchington, near Southam and Long Itchington, and thus on to Marton, receiving in its course the waters running from the Burton Hills, Harbury, Wormleighton, Ladbrooke, and the Napton Hills; it has a course of about eighteen miles, but although draining so large a portion of the county it is only in rainy seasons that it assumes more than a brook-like character. Near Radford the Leam receives a small brook draining a part of Chesterton and Harbury.

The Stour rises on the south-west side of the Edge Hills, near Brailes, and flows north-west through Cherrington, Burmington, Shipston-on-Stour, Halford, Alderminster, and Atherstone-on-Stour, enters the Avon about two miles below Stratford-on-Avon. Its course is about twenty-four miles, and it receives numerous streams draining Long Compton, Tysoe, Brailes, Whatcote, and the country around the Vale of the Red Horse.

The Arrow rises in Worcestershire in a valley to the north-east of Alvechurch, and takes a straight course southward. It enters Warwickshire on its western border near Beoley Lane, having just before received a small stream draining the outlying portion of Warwickshire, near Redditch. In its course it passes near Ipsley, Studley, and Alcester, increased by the streams draining Ipsley, Morton Bagot, and Cold Comfort. On the east of Alcester it receives on its left bank its principal feeder, the River Alne. From Alcester it flows through Arrow, Wixford, and Broome, and joins the Avon on its right bank near Salford Priors. Near Salford it receives small streams draining Ragley and Bevington. Its whole course is about twenty miles, sixteen miles of which are in Warwickshire.

The Alne has two principal sources; the main source is a stream rising near Wroxall Abbey, which takes a westerly direction, draining Wroxall, Rowington, and Preston Bagot. Near Preston Bagot it receives a small stream which rises near Chalcot Wood, flows under Lapworth Bridge, and near Bush-wood Hall. The main stream runs on to the lake by Wootton Hall, and here is joined by its second principal feeder. This stream rises near Tanworth, and takes an easterly direction through Tanworth, Henley-in-Arden, and Beaudesert, and joins the main stream in the lake before mentioned. The united stream runs on near Aston Cantlow and through Great Alne to Alcester, receiving in its course the streams draining Pinley, Langley, Bearley, Oversley Wood, and Haseler. Its length is about fourteen miles.

The second principal river of Warwickshire is the Tame. "This river takes its rise in the south of Cannock Chase, collecting water from the Silurian hills in the neighbourhood of Dudley, and also from the country east of Wolverhampton, especially from the western side of the ridge commencing with Hampstead Hill, and extending northwards several miles. The numerous feeders bring their waters together near West Bromwich, and proceed thence, passing to the north of Birmingham."*

The Tame enters Warwickshire near the Witton Lane, flowing to the east, past Aston Church, and under Salford Bridge, near which it receives its first principal feeder, the River Rea. A mile farther on it receives on its right bank a stream draining part of Saltley, Washwood Heath, and Ward End. Two miles from this it receives two small feeders on its left bank, the first of which drains Erdington, the second drains Sutton Park, Sutton, Maney, New Hall, Penns, and Popes Hayes. A course of about six miles from this point takes it through Water Orton to the grounds around Hams Hall, and it receives on its way streams draining Minworth, Curdworth, and part of Wishaw, which enter on its left bank. Near Hams Hall it is joined by the River Blythe, which has received the Cole about a mile before the confluence of the former with the Tame. The Blythe joins the Tame on its right bank; about half-a-mile farther on it receives on the same bank the small River Bourne. The Tame, now become a considerable stream, takes a course nearly due north, past Lea Marston and Kingsbury, receiving on each bank feeders draining Bodymoor Heath, Whitacre, and Bodymoor Green. Near Kingsbury it receives

* Water and Water Supply, Prof. D. T. Ansted, p. 300.

on its right bank a confluence of streams, draining Baxterly, Hurley, and a rather extensive country east of the Tame. About two miles north of Kingsbury it receives Langley Brook, which passes through Middleton and Middleton Park, and enters the Tame on its left bank, near Fisher's Mill, bringing the waters of a wide area west of the Tame, draining Langley, Wishaw, Canwell Gate, New Park, and the surrounding district. About one mile from Tamworth the Tame receives a small feeder, draining Wilnecote, and at Tamworth its tributary, the Anker, both these streams joining it on its right bank. Passing south of Tamworth at Lady Bridge the Tame enters Staffordshire, and about eight miles farther on joins the Trent, near Alrewas.

The Blythe rises on Shirley Heath, and receives several small feeders from the high ground near Tanworth and Earlswood, draining a considerable portion of the western boundary of Warwickshire. At first it takes a north-west course, flowing under Monks' Path, Blythe Bridge, near Malvern Hall, and Escole Hall, receiving on its way two or three small feeders. After passing Escole Hall, it takes a curved course south for about four miles to Temple Balsall, where it receives a confluence of waters, forming the drainage of Knowle, Kingswood, Packwood, and Hockley. At Temple Balsall it bends round and takes a northerly course, near Barston, Righton End, and Bradnock's Marsh, to Stonebridge, receiving on both banks feeders draining a large expanse of country, including a portion of Wroxall, Balsall Common, Berkswell, Escole Green, and Hampton-in-Arden. From Stonebridge it continues a much-curved course northwards, through Little Packington, Maxtoke, and near Blythe Hall, entering the Tame on its right bank near Hams Hall. About a mile before reaching the Tame it has received its principal tributary, the Cole, and in its course from Stonebridge has received on both banks numerous feeders, draining Bickenhill, Maxtoke, and a portion of Meriden.

The Cole rises south-east of King's Norton, and running through Greet skirts the county for several miles, forming the boundary of that peninsula of Worcestershire in which Yardley is situated. It enters Warwickshire near Babb's Mill, taking a somewhat easterly meandering course, past Chelmsley Wood, near which it receives the waters from around Olton, Solihull, Hampton Coppice, Marston Green, and Bickenhill. A little beyond Chelmsley it takes a north-east course through Coleshill Park, past the lower end of Coleshill, and joins the Blythe near Forge Mills. Its course is about nine miles.

The Bourne rises in the elevated land on Corley Moor, and takes a north-west course through Fillongley and Shustoke to its confluence with the Tame, near Hams Hall. It receives in its short course the waters of an extensive and interesting district, draining the lower part of Bentley, Ansley, Arley, a portion of Corley, and a considerable portion of the woodlands south-east of the Tame. Its course is not more than five or six miles, and it is rarely more than a slight stream.

The Anker has its source from a confluence of several small streams draining Bulkington, Wolvey, and Burton Hastings. It takes a north-west course through Attlebury fields and near Chilvers Coton; here it receives on its left bank a stream which drains a large area of the coal measures around Bedworth, Chilvers Coton, and Nuneaton. Pursuing its course northwards, it runs through Nuneaton, Weddington, Caldecote, and Mancetter. Passing Atherstone on its east side, it receives the waters of the River Sence, which drains a considerable portion of the adjacent county, Leicestershire. After its confluence with the Sence the Anker flows north-west through Grendon Park, and west through Polesworth. After this its course is very winding, making considerable curves, north and south, before it reaches its confluence with the Tame. In its course from Polesworth it receives feeders, bringing the waters from Seckington, Austrey, and the surrounding district.

CLIMATE.—"The insulated position of this county and its freedom from any great inequalities of surface render the climate mild, and the vegetation early. The winds most prevalent are from the south-west, and are frequently accompanied with rain; but occasionally, toward the middle of May, the effects of an easterly variation are felt. The county, however, is not subject to any particular excess of damp or cold."*

NUMBER OF SPECIES AND TYPES OF DISTRIBUTION.

Of the 1,680 species named in the "London Catalogue of British Plants," (Seventh Edition,) 960 have been recorded as occurring in Warwickshire. To these may be added twenty-six species belonging to the excluded list, making a total of 986. By the aid of Mr. Hewett C. Watson's valuable "Compendium of the Cybele Britannica," I have made the following approximate analysis of the Warwickshire Flora:—

Native	836
Colonist	49
Denizen	23
Alien	43
Casual	35
	986

These will come under the following types, as given in the above-named work:—

British	484
English	257
Intermediate	16
Scottish	13
Germanic	50
Atlantic	10
	830

The remaining plants are segregates, introductions, &c., not classified in that work.

(To be continued.)

* History of Warwickshire, William West.

A DREAM OF OLTON, 1879.*

Fired with a zeal for microscopic work,
I sought fair Olton's reservoir, where lurk
Beneath its placid surface forms unknown
Not few: in hope to find I went, alone,
Nor unsuccessful, for the nymphs were kind.
Tired, on the turf at length I lay reclined—
Then softly stole upon my slumbering ears
The tiny music of the volvox-spheres.

Methought I saw an ocean, pure and bright,
Wherein a host, in curious armour dight,
Of filmy creatures sped their devious way,
And each to other fell a ceaseless prey.
Beneath the surface, scarce a fathom deep,
Leptódora plies his oars with steady sweep;
Or smoother still, as Leptodóra glides,
And from his foes in mere transparence hides.
Ah me! what wordy war was waged amain
O'er thee, Leptodora, but waged in vain.
Here Cyclops slowly winked his solemn eye,
There Daphnias swore to conquer or to die,
While Vorticellæ, with a causeless fear,
Coiled and uncoiled themselves, and ever near
Fair Melicerta showed her modest charms,
Built her toy-house, or shrunk with coy alarms.
The Stentor blew a blast both long and loud,
Euglenæ postured to amuse the crowd,
And Peridinia, phosphorescing, roam
To light benighted Rotatoria home.
These cluster here and there: in other parts
Ceratium rolls and Anuræa starts,
And with his hat and rollicking round eye,
Field-Marshal Kahlbergensis swaggers by.

A shadow fell upon the peaceful shore.
Four monsters, huge, unchained, with ample store
Of weapons dire, with horrid purpose fraught,
This sacred haunt of Nature's children sought.
Embarked upon a skiff, they ranged the pool;
The fiercest held on high a murderous tool—
A long stout staff of oak, begirt with brass,
A spacious cavern of translucent glass.
This plunged, inverted, far beneath the wave,
Frightened the timid and engulphed the brave,
The few escaped their ravaged homes to wail,
The vision vanished, and thus ends my tale.

GAMMA.

* We need scarcely remind our readers that Olton Reservoir was the place where a party of the Birmingham Natural History Society first discovered *Leptodora hyalina*, and other species new to Britain.—See "Midland Naturalist," 1879, pp. 217, 225, 241, 310, and 1880, p. 20.

ON THE DESMIDIEÆ OF NORTH WALES.

During the unusually hot month of August of last year, I spent several weeks at Capel Curig, making that place my centre, and taking daily rambles in the neighbourhood extending to Beddgelert, Ffestiniog, the Ogwen Valley, and to every peak and ridge in the ranges of Snowdon, the Carnedds and the Glyders; and, of course, to the intervening valleys, with their streams and bogs, and to the wild moorlands in which the district abounds. These latter are the especial haunts of those beautiful plants, the Desmidieæ, but the long drought which prevailed at that time had dried up most of the pools and boggy places in which they are to be chiefly sought, and, on the whole, my gatherings were disappointingly few in number and unproductive in kind, although here and there some rare species was found. During these rambles, I had many times passed and re-passed the little foot bridge which spans the river issuing from Capel Curig lakes and leads across into the wooded slopes of Moel Siabod, and had often lingered to watch the sportive movements of the shoals of small fish which were constantly gambolling in the sun. On the last day of my stay, I was enjoying the *dolce far niente* at this spot, and regretting mentally that next morning would see me with my neck in the accustomed collar, when my eye rested on certain small bright green spheres among the weeds below, and I immediately fetched a bottle and bore some of them off to my lodgings for cursory examination. They proved to be masses of the well-known Infusorian, *Ophrydium versatile*, but attached to or embedded in these were several Desmidieæ new to me, and on examining fragments of the weeds which accompanied the Ophrydium, I found that these were the nidus of still larger numbers of the Desmids. I had only time to run down to the lake with two or three bottles, and to cram these with myriophyll and other water weeds, and to take my departure from these happy hunting grounds by the inevitable coach.

On my arrival at home, this material was well washed out in a basin of water, and the resulting sediment transferred to several large bottles, and for some days frequent changes of water made, so as to get rid of the bulk of the slimy unstable vegetable matter which abounded. There remained a flucculent brown deposit at the bottom of each vessel, very rich in Desmidieæ, and affording ample scope for many evenings' work. This material proved extremely rich in those elegant, but very puzzling plants, the Staurastra. A considerable number of species, both of this and of other genera, are hitherto unrecorded in England; others have not been detected in any part of Great Britain, while several appear to be hitherto unknown.

I have here gratefully to acknowledge the great kindness of Dr. M. C. Cooke, to whom I have submitted either specimens or drawings of the whole of these new or rare species, and who has not only given me the benefit of his large knowledge of this family of plants, but has taken the trouble to examine a large number of the original specimens of Nordstedt, Wittrock, and other Continental botanists, in order to ensure accuracy in the process of identification, and to avoid the possibility of describing as a new species some organism which may have been already recognised as belonging to either the European or extra-European flora.

I would here also say a few words as to the paramount importance of recording with accuracy the dimensions of microscopic objects, and of delineating those of any particular class to some uniform and convenient scale.

Many works on the subject of fresh-water Algæ lose much of their value from defective records of these particulars, and even the admirable essay of Ralfs on the British Desmidieæ is blemished by the want of uniformity of scale in the beautiful drawings which illustrate it; hence a tedious process of calculation from the actual dimensions is necessary before a just comparison can be instituted between these several figures, or between these and any specimens under observation.

A convenient amplification in sketching the Desmidieæ is that of 400 diameters, and by operating on some object of known size it is easy to ascertain, once for all, by what arrangement of the microscope, its objectives and eyepieces, this amplification is obtained in the apparent image formed by the camera lucida, or neutral tint reflector. Thus, with my Ross microscope, the tube being placed nearly horizontally, (10¾ inches from bottom of eyepiece to surface of paper,) ¼ inch objective and B eyepieces give an image of an object placed on the stage which is magnified by 400 diameters. A corresponding scale representing 1-10th of a millimetre divided into ten parts, each therefore = ·01 mm., being applied to any drawing made in this manner, the actual dimensions of the object which it represents are read off at once.

This unit, ·01 mm., is recognised by Continental botanists under the symbol μ, and the dimensions of the Desmidieæ are recorded in the following manner:—*e.g.*, "Long. 21 μ; Lat. = 20 — 21 μ; Lat. isthmi 5 μ." It is only in this country that the barbarous notation of inches and their decimal parts still lingers.

This scale is adopted by Dr. Cooke in the measurement of sporidia and other microscopic organisms to which an equal amplification is conveniently applied. The value of a uniform system of this kind is self-evident. It enables correspondents at once to institute a just comparison between their specimens without a laborious process of calculation; and it is much to be desired that some such arrangement, based on the metrical system, should be universally adopted in the descriptions and illustrations of microscopic organisms contained in scientific works, and in the transactions of all societies devoted to the study and investigation of such subjects. I should rejoice to see the Midland Union of Natural History Societies, and its excellent medium "The Midland Naturalist," taking the lead in the introduction of this simple but important reform.

The following list of Desmidieæ comprises those found in the neighbourhood of Capel Curig during the month of August, 1880, to which are added some few taken during previous visits to North Wales.

It necessarily includes the common as well as the rare species. Those which have not hitherto been recorded from English habitats, but which have been detected in Ireland or Scotland, are indicated by an asterisk; those which have not been hitherto discovered in the United Kingdom, but which are known as European, American, or Arctic species, by two asterisks.

A notice of those believed to be wholly new will appear in a future number of the "Midland Naturalist."

ABBREVIATIONS.

Bréb., De Brébisson.
Ehr., Ehrenberg.
Hass., Hassall.
Kütz., Kützing.
Lund., Lundell.
Menegh., Meneghini.
Näg., Nägeli.
Nords., Nordstedt.
Wittr., Wittrock.

*Gonatozygon Brébissonii, De Bary.
Ralfsii, De Bary.
Hyalotheca dissiliens, Bréb.
mucosa, Ehr.
Didymoprium Borreri, Ralfs.
Grevillei, Kütz.
Desmidium aptogonum, Bréb.
Swartzii, Agardh.
Sphærozosma excavatum, Ralfs.
vertebratum, Ralfs.
*Spondylosium pulchellum, Archer.
*Tetrachastrum mucronatum, [Dixon.
oscitans, Hass.
pinnatifidum, Kütz.
*Micrasterias angulosa, Hantsch.
Americana.
** „ forma major, [Reinsch.
crenata, Bréb.
denticulata, Bréb.
fimbriata, Ralfs.
furcata, Agardh.
Jenneri, Ralfs.
papillifera, Bréb.
radiosa, Agardh.
rotata, Ralfs.
truncata, Bréb.
Euastrum affine, Ralfs.
ampullaceum, Ralfs.
ansatum, Ehr.
binale, Ralfs.
* „ var. augustatum, [Wittr.
Euastrum crassum, Kütz.
cuneatum, Jenner.
Didelta, Ralfs.
elegans, Bréb.
gemmatum, Bréb.
insigne, Hass.
oblongum, Ralfs.
pectinatum, Bréb.
verrucosum, Ehr.
Cosmarium bioculatum, Bréb.
biretum, Bréb.
Botrytis, Menegh.
Brébissonii, Menegh.
cœlatum, Ralfs.
connatum, Bréb.
conspersum, Ralfs.
crenatum, Ralfs.
Cucumis, Corda.
Cucurbita, Bréb.
*cyclicum, Lund.
cylindricum, Ralfs.
granatum. Bréb.
*Holmiense, Lund.
** „ var.
**læve, Nordst. and Wittr.
margaritiferum, [Menegh.
Meneghinii, Bréb.
moniliforme, Ralfs.
**nitidulum, de Notaris.
*Nymannianum, [Grunow.
orbiculatum, Ralfs.
ornatum, Ralfs.

Cosmarium Phaseolus, Bréb.
**præmorsum, Bréb.
*pseudo-connatum, [Nordst.
**pseudo-nitidulum, [Nordst.
*pseudo-pyramidatum, [Lund.
pyramidatum, Bréb.
Ralfsii, Bréb.
tetraophthalmum, [Kütz.
tinctum, Ralfs.
*truncatellum, Perty.
undulatum, Corda.
*variolatum, Lund.
*Xanthidium armatum, Bréb.
Brébissonii, Ralfs.
cristatum, Bréb.
fasciculatum, Ehr.
Arthrodesmus Incus, Hass.
octocornis, Ehr.
Staurastrum aculeatum, Menegh.
alternans, Bréb.
Arachne, Ralfs.
*Arctiscon, Lund.
aristiferum, Ralfs.
*aversum, Lund.
Avicula, Bréb.
brachiatum, Ralfs.
**Brasiliense, Lund.
*Cerastes, Lund.
controversum, Bréb.
*cristatum, Näg. var.
cuspidatum, Bréb
cyrtocerum, Bréb.
dejectum, Bréb.
furcigerum, Bréb.
gracile, Ralfs.
**grande, Lund.
hirsutum, Bréb.
**inflexum, Bréb.
læve, Ralfs.
*longispinum, Bailey.
margaritaceum, Menegh.
**megacanthum, Lund.
muticum, Bréb.
*Ophiura, Lund.
orbiculare, Ralfs.
paradoxum, Meyen.
* ,, var. longipes, [Nordst.
polymorphum, Bréb.
*Pringsheimii, Reinsch.
Staurastrum **pseudofurcigerum, [Reinsch.
punctulatum, Bréb.
**Sebaldi, Reinsch.
spinosum, Ralfs.
spongiosum, Bréb.
teliferum, Ralfs.
tetracerum, Ralfs.
tricorne, Bréb.
tumidum, Bréb.
vestitum, Ralfs.
Docidium Baculum, Bréb.
clavatum, Kütz.
Ehrenbergii, Ralfs.
minutum, Ralfs.
nodosum, Bailey.
nodulosum, Bréb.
truncatum, Bréb.
Tetmemorus Brébissonii, Ralfs.
granulatus, Ralfs.
lævis, Ralfs.
Closterium acutum, Bréb.
angustatum, Kütz.
attenuatum, Ehr.
Cornu, Ehr.
costatum, Corda.
*Cynthia, de Notaris.
Dianæ, Ehr.
didymotocum, Corda.
,, var. Baileyanum.
*gracile, Bréb.
intermedium, Ralfs.
Jenneri, Ralfs.
juncidum, Ralfs.
Leibleinii, Kütz.
lineatum, Ehr.
Lunula, Ehr.
moniliferum, Ehr.
Ralfsii, Bréb.
rostratum, Ehr.
setaceum, Ehr.
striolatum, Ehr.
turgidum, Ehr.
Penium Brébissonii, Menegh.
closterioides, Ralfs.
Cylindrus, Bréb.
Digitus, Bréb.
interruptum, Bréb.
margaritaceum, Bréb.
*Nägelii, Bréb.
truncatum, Bréb.
Spirotænia condensata, Bréb.
obscura, Ralfs.

A. W. Wills.

January 20, 1881.

METEOROLOGY OF THE MIDLANDS.
THE WEATHER OF DECEMBER, 1880.

BY W. JEROME HARRISON, F.G.S.

STATION.	OBSERVER.	RAINFALL. Total for M.	Greatest fall in 24 hours.		No. of rainy d.	TEMPERATURE. Greatest ht.		Great'st cold	
		In.	In.	Date.		Deg	Date.	Deg	Date.
GLOUCESTERSHIRE.									
Cheltenham	R. Tyrer, Esq.	2·92	·40	14	17	55·0	10	24·0	26
Strond	S. J Coley, Esq	2·88	·48	20	12	55·0	11	28·0	22, 25, 26
SHROPSHIRE.									
Haughton Hall, Shifnal	Rev. J. Brooke	3·58	·59	29	21	53·0	9	23·0	22
Woolstaston	Rev. E. D. Carr	4·35	·98	29	19	52·5	6	24·0	17
[illegible] Rectory, Bishop's Castle	Rev. A. Male	4·15	·67	29	20	54·0	6, 7, 9	24·0	18
Larden Hall	Miss F. R. Boughton	3·32	·60	26	17				
Cardington	Rev. W. Elliot	4·11	·85	26	16				
HEREFORDSHIRE.									
Stoke Bliss	Rev. G. E. Alexander	3·02	·49	29	17	55·0	10	29·0	16 & 25
WORCESTERSHIRE.									
Orleton, Tenbury	T. H. Davis, Esq.	3·45	·63	29	19	56·0	4	24·5	26
West Malvern	A. H. Hartland, Esq.	3·43	·52	28	13	53·5	10	26·0	24
Evesham	T. J Slatter, Esq.	2·89	·56	22 & 23	18	54·3	10	25·3	26
Dowles, Bewdley	J. M. Downing	3·45	1·45	29		43·0	4	19·0	22 & 26
Pedmore	E. B. Marten, Esq.	3·40	·54	29	21	55·0	9	23·0	16 & 25
Stourbridge	I. Jefferies, Esq.	3·17	·52	s)26 & 29	17	56·0	10	26·0	25
Dennis, Stourbridge	C. Webb, Esq.	2·98	·60	s) 26	20	54·0	9 & 10	26·0	25
STAFFORDSHIRE.									
Weston-under-Lyziard R'tory	Hon.and Rev.J. Bridgeman	3·77	·56	21	21	51·0	6 & 10	20·0	18
Wrottesley	E. Simpson, Esq.	3·55	·68	29	18	53·8	7	24·6	26
Heath House, Cheadle	J. C. Phillips, Esq.	5·12	·91	29	24	53·0	6	23·0	27
Alstonfield Vicarage	Rev. W. H. Purchas	7·30	1·32	15	17	49·6	7	16·6	21 & 22
Kinver	Rev. W. H. Bolton	3·14	·41	s)26 & 29	21	54·0	10	26·0	25
Walsall	Mr. N. E. Best	3·46	·54	21	20	51·0	10	25·0	16, 17, 25
Lichfield	Mr. J. P. Roberts	3·57	·51	29	21				
Burton-on-Trent	C. U. Tripp, Esq.	3·39	·50	29	23	55·0	6	22·0	26
Beacon Stoop, Weaver Hills	C. L. Wragge, Esq.	4·03	·65	29	23	51·3	11	25·2	20
Farley, near Cheadle	C. L. Wragge, Esq.	5·32	·83	29	23	53·6	6	26·7	22 & 26
Oakamoor	E. C. Kettle, Esq.	5·67	·93	29	21	51·7	6	20·3	22
WARWICKSHIRE.									
Bickenhill Vicarage	J. Ward, Esq.	3·48	·75	21	11	48·0		27·0	
St. Mary's College, Oscott	Rev. S. J. Whitty	3·35	·47	29	20	55·3	6	26·9	26
Henley-in-Arden	T. H. G. Newton, Esq.	3·41	·47	26 & 29	20	56·0	10	25·0	22 & 26
Rugby School	Rev. T. N. Hutchinson	4·03	·59	22	21	54·4	10 & 11	26·0	26
DERBYSHIRE.									
Stoney Middleton	Rev. U. Smith	5·12	1·01	27	15	50·0	4, 9, 22	19·0	20 & 21
Fernslope, Belper	F. J. Jackson, Esq.	4·21	·57	29	21	54·0	6 & 10	27·0	22, 26, 27
Linacre Reservoir	C. E. Jones, Esq.	3·72	1·02	29	20				
Spondon	J. T. Barber, Esq.	3·91	·51	15	21				
Duffield	W. Bland, Esq.	4·00	·56	29	26				
NOTTINGHAMSHIRE.									
Tuxford	J. N. Dufty, Esq.	2·32	·42	23	14	51·0	6	26·0	16 & 24
Hodsock Priory, Worksop	H. Mellish, Esq.	3·09	·94	29	18	58·8	6	24·0	17
LEICESTERSHIRE.									
Loughborough	W. Berridge, Esq.	2·94	·47	29	21	56·6	6	26·5	17
Kibworth	T. Macaulay, Esq.	2·86	·39	26	22	52·0	10	25·0	2
Syston	J. Hames, jun., Esq.	2·72	·50	27	19	51·0	11	25·0	22
Waltham-le-Wold	E. Ball, Esq.	2·68	·38	15	18	51·0	23	28·0	20
Coston Rectory, Melton	Rev. A. M. Rendell	2·63	·38	15	21	53·4	6	20·3	22
Dalby Hall	Mr. G. Jones	2·38	·31	29	20	53·0	9	22·0	17
NORTHAMPTONSHIRE.									
Towcester Brewery	J. Webb, Esq.	2·50	·50	26	15				
Castle Ashby	R. G. Scriven, Esq.	2·70	·50	22	15	53·0	8	28·0	25
Kettering	J. Wallis, Esq.	2·93	·50	26	19	53·0	11	28·0	17 & 26
Althorp	G. S. Groom, Esq.	3·22	·51	22	18	53·0	10	23·0	21
RUTLAND.									
West Deyne, Uppingham	Rev. G. H. Mullins	2·30	·29	26	22	52·9	10	27·2	26
Altarnun, Cornwall	Rev. J. Power	8·68	1·30	15	21	53·0	23	29·0	27 & 28
Ventnor	W. T. Ryder, Esq.	5·16	·76	29	20	55·1	3, 10, 28	31·4	25

The first half of the month was mild and fairly pleasant, with a high barometer. Bats were seen flying about in several localities until the 14th, and many plants, as the clematis, lilac, &c., put forth their buds. Pressure began to decrease on the 14th, and the latter half of the month was very unsettled, slight frosts alternating with thaws. Christmas Day was fine and seasonable, but a heavy fall of snow occurred on the night of the 26th-27th, lying from 4in. to 8in. deep, but disappearing on the 28th. The temperature (about 40°) was above the average for this month, and the total rainfall was also in excess. A lunar halo was seen at Loughborough on the 12th. So ends another wet and trying year; the promise of the first six months of 1880 was excellent, but the heavy rains of the latter half of the year completely belied the promise of the spring.

Being no longer, from stress of other work, an active Meteorological observer, I have induced Mr. Clement L. Wragge, F.M.S., F.R.G.S., of Farley, near Cheadle, Staffordshire, to undertake the Meteorological Department of this Magazine; and all future communications on the weather should be sent to him. In parting company with the large band of observers who have aided me so well during the past three years, I beg to thank them very sincerely for all the trouble they have taken, and for the scientific care, promptitude, and accuracy which they have displayed. I know my successor to be a most able and enthusiastic Meteorologist, and under his charge I am sure the work will be continued with increasing efficiency.—W. JEROME HARRISON.

Correspondence.

LIST OF PLANTS FLOWERING IN NEIGHBOURHOOD OF FALMOUTH, DECEMBER, 1880, AND JANUARY, 1881.

WILD PLANTS.

Ranunculus repens,* from December 1 to January 5, 1881, continuously.
,, acris, Dec. 10.
Fumaria capreolata,* from December 1 to January 5, 1881, ,,
,, officinalis,* ,, ,, ,, ,, ,,
Capsella Bursa-pastoris,* ,, ,, ,, ,, ,,
Lepidium Smithii, December 26.
Cochlearia Danica, ,, 21.
Coronopus Ruellii,* from December 1 to January 5, 1881, ,,
,, didyma,* ,, ,, ,, ,, ,,
Cardamine hirsuta,* ,, ,, ,, ,,
Sisymbrium officinale,* ,, ,, ,, ,,
Brassica oleracea, December 26.
Sinapis arvensis,* from December 1 to January 5, 1881, ,,
,, alba, December 26th.
Reseda Luteola, ,,
,, lutea, ,,
Viola canina,* from December 1 to January 5, 1881, ,,
Silene inflata, December 10.
Lychnis dioica,* from December 1 to January 5, 1881 ,,
,, vespertina, ,, ,, ,, ,,
Sagina procumbens, December 21.
Spergula arvensis,* from December 1 to January 5, 1881, ,,
Stellaria media,* ,, ,, ,, ,, ,,
,, graminea, December 10.
Cerastium viscosum,* from December 1 to January 5, 1881, ,,
Geranium Robertianum,* ,, ,, ,, ,,
,, molle, December 21
,, dissectum, ,,
Oxalis corniculata, ,,
Ulex Europæus, from December 1 to January 5, 1881, ,,

Trifolium repens, December 10.
Vicia sativa, ,, 26.
Geum urbanum,* from December 1 to January 5, 1881, continuously.
Potentilla reptans, December 26.
,, Fragariastrum, ,,
Rubus fruticosus, from December 1 to January 5, 1881, ,,
Epilobium parviflorum, December 10.
Smyrnium olusatrum, December 10.
Apium graveolens, from December 1 to January 5, 1881, ,,
Fœniculum vulgare, December 10.
Heracleum Sphondylium,* from December 1 to January 5, 1881, ,,
Anthriscus sylvestris, from December 26 to January 5, 1881, ,,
Daucus Carota,* from December 1 to January 5, 1881, ,,
,, maritimus,* ,, ,, ,, ,,
Hedera Helix, December 10.
Sherardia arvensis, from December 21 to January 5, 1881, ,,
Centranthus ruber, January 5.
Scabiosa succisa, December 10.
Knautia arvensis, ,,
Helminthia echioides, from December 1 to January 5, 1881, ,,
Thrincia hirta,* ,, ,, ,, ,, ,,
Hypochæris radicata,* ,, ,, ,, ,, ,,
Sonchus oleraceus,* ,, ,, ,, ,, ,,
,, asper, ,, ,, ,, ,, ,,
Crepis virens,* ,, ,, ,, ,, ,,
Leontodon Taraxacum,* ,, ,, ,, ,,
Lapsana communis,* ,, ,, ,, ,, ,,
Centaurea nigra, till December 21.
Senecio vulgaris,* from December 1 to January 5, 1881, ,,
,, Jacobæa,* ,, ,, ,, ,,
Bellis perennis,* ,, ,, ,, ,,
Chrysanthemum Leucanthemum,* ,, ,, ,,
,, segetum,* ,, ,, ,, ,,
Pyrethrum Parthenium, ,, ,, ,, ,,
,, inodorum,* ,, ,, ,, ,,
Achillea Millefolium,* ,, ,, ,, ,,
Jasione montana,* ,, ,, ,, ,,
Erica cinerea, till December 26.
Erythræa Centaurium, from December 1 to January 5, 1881, ,,
Borago officinalis, January 1.
Linaria Cymbalaria,* from December 1 to January 5, 1881, ,,
Sibthorpia Europæa, ,, ,, ,, ,, ,,
Veronica serpyllifolia, ,, ,, ,, ,, ,,
,, arvensis, ,, ,, ,, ,, ,,
,, hederifolia, ,, ,, ,, ,, ,,
,, agrestis,* ,, ,, ,, ,, ,,
,, polita, ,, ,, ,, ,, ,,
,, Buxbaumii,* ,, ,, ,, ,, ,,
Thymus Serpyllum, January 5.
Teucrium Scorodonia, till December 26.
Galeopsis Tetrahit ,, ,,
Lamium purpureum,* from December 1 to January 5, 1881, ,,
,, incisum.
Betonica officinalis,* ,, ,, ,, ,, ,,
Stachys sylvatica, ,, ,, ,, ,, ,,
,, arvensis,* ,, ,, ,, ,, ,,
Prunella vulgaris, till 26th December.
Primula vulgaris,* from December 10 to January 5, 1881, ,,

Anagallis arvensis,* from December 1 to January 5, 1881, continuously.
,, cærulea, January 1.
Armeria maritima,* from December 1 to January 5, 1881, ,,
Beta maritima, December 26.
Polygonum aviculare, December 26.
Rumex obtusifolius, from December 1 to January 5, 1881, ,,
Euphorbia helioscopia,* ,, ,, ,, ,,
Euphorbia Peplus,* from December 1 to January 5, 1881, ,,
Urtica urens, December 26.
Parietaria officinalis, from December 1 to January 5, 1881, ,,
Ruscus aculeatus,* ,, ,, ,, ,, ,,
Poa annua* and other grasses, ,, ,, ,, ,,

N.B.—Plants marked * flowered freely. Total 100.

GARDEN PLANTS FLOWERING IN OPEN AIR, DECEMBER 1, 1880, TO JANUARY 5, 1881,

Fuchsias	Brugmansia
Veronicas	Verbenas
Geraniums	Calceolaria
Hydrangeas	Abutilon
Escallonias	Fragaria indica
Rhododendrons	Yucca
Desfontainea spinosa	Camellia, from Dec. 25
Aralia Sieboldii	&c., &c., &c.

HOWARD FOX, Falmouth, January 5, 1881.

PHENOLOGICAL OBSERVATIONS made in the vicinity of Farley, Staffordshire, during October, November, and December, 1880 :—October 1st.—General blackberry harvest very good, some very fine fruit, especially as to size, but much spoilt by grub nevertheless ; leaves of Lime falling. 2nd.—Foliage of Churnet Valley Woods still, isolated cases excepted, in good condition. 3rd.—Sycamore by now shedding leaves; young Elms also, one of latter nearly bare. 5th.—Horse Chestnut in defoliation. 11th.—Harebell (*Campanula rotundifolia*) in full flower on Beacon Stoop, 1,216ft. above sea level. 14th.—Last Swallow seen by assistant on Weaver Hills. 15th.—*Scabiosa arvensis* still in flower, and *Hieracium Pilosella* on the slopes of Weaver ; also *Ranunculus bulbosus* and *R. acris*. 18th.—*Geranium Robertianum* well in flower in crevices of limestone rocks, 1,050ft. above sea ; one well-set flower of *Stachys sylvatica* noticed in sheltered spot, by wood, at foot of Beacon Stoop, about 800ft. above sea level ; *Prunella vulgaris*, *Erythræa Centaurium*, *Trifolium pratense*, *Origanum vulgare*, *Centaurea* (*nigra ?*) and Vetch still in flower in mountain limestone district, about 855ft. above sea. 19th, 20th.—By now specimens of Sycamore and Lime *nearly* bare ; *Geranium pratense* in full flower in limestone district. 25th.—*Achillea Millefolium* still in flower by old limekilns near foot of Beacon Stoop; fruit of Elder in Weaver Fields not fully ripened, blighted by frost and previous N.E. gales. 29th.—*Centaurea (nigra ?,) Campanula rotundifolia*, *Senecio Jacobæa* and *Geranium Robertianum* in flower still between Farley and Oakamoor, in loamy soil by wayside. 31st.—*Primula veris* (Cowslip) in flower in my garden ; very few berries of *Pyrus aucuparia*.—November 1st.—Last flowers of *Veronica Beccabunga* and *Ranunculus Flammula* ; former in marshy ground by wayside at Ramsor, about 800 feet above sea level, latter in wet fields. 5th.—Assistant brought me one of last flowers of *Digitalis purpurea*. 10th.—*Senecio Jacobæa* still in flower in Weaver Fields. 21st.—Ice first "bearing," about 1½ inch thick; skating at Alton on 23rd. 24th.—*Turdus pilaris*, in a flock of about twenty, first seen by assistant at foot of Weaver Hills.—December 8th.—Yellow Jasmine in full flower over house porch at Alton. 10th to end of month.—*Primula veris* still in flower in my garden at Farley; *Geranium Robertianum* in full flower and fairly vigorous during entire month in old limekilns near foot of Beacon Stoop.—Clement L. Wragge, F.R.G.S., F.M.S.

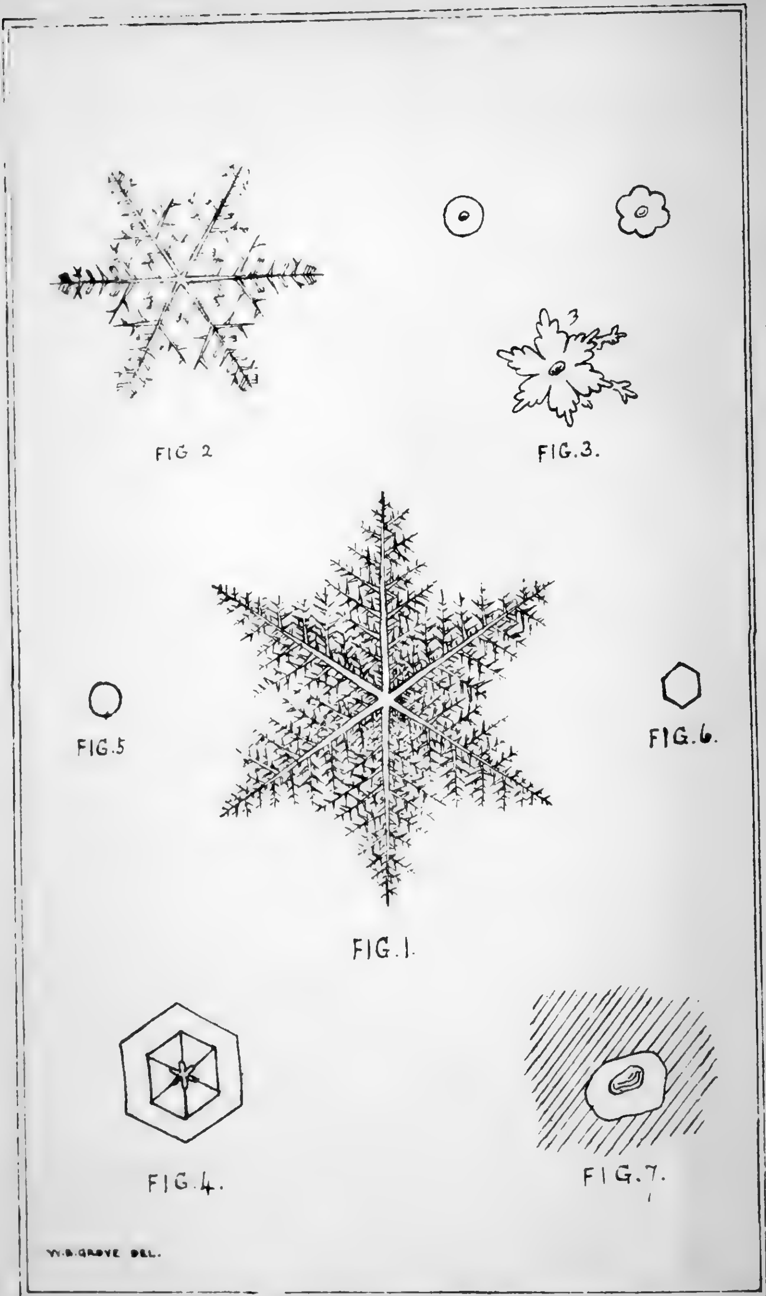
Reports of Societies.

BIRMINGHAM NATURAL HISTORY AND MICROSCOPICAL SOCIETY.—Microscopical General Meeting, January 18th.—Mr. Bolton reported the capture of one male and several female specimens of *Chirocephalus diaphanus*, from the locality mentioned at the last meeting. Mr. Pickering exhibited *Cordiceps militaris*, Fries, a beautiful scarlet fungus parasitic on the larvæ and pupæ of moths. Mr. Morley confirmed the statement in the "Royal Microscopical Society's Journal" of the power possessed by a saturated solution of carbolic acid to render transparent, in a few minutes, many objects which must be soaked in turpentine for several days before the same effect is produced. He asserted that, when the object is afterwards mounted in Canada balsam, the balsam follows the carbolic acid as readily as it does turpentine. Mr. G. E. Davis, F.R.M.S., then read an interesting and highly practical paper on "Photo-micrography." He gave a description of the mode of arranging the light, microscope, and camera, and recommended the use of a dry plate for receiving the image. He also gave a list of magnifying powers, with various objectives, at a fixed distance of thirty-six inches, a table of the lengths of exposure required, and of the correction of the fine adjustment necessitated by the difference between the visual and actinic foci. Many beautiful photographs were exhibited in illustration.

BIRMINGHAM AND MIDLAND INSTITUTE SCIENTIFIC SOCIETY. —December 29th.—The annual *soirée* was held in the Bristol Street Board Schools. The scientific exhibition included the following experiments:—Combustion of air in coal gas, decomposition of steam by magnesium, relative transparency of different media to radiant light and heat, material nature of the atmosphere, molecular structure in its relation to polarised light, and Balmain's luminous paint. A vocal and instrumental concert was followed by dancing, which was kept up till midnight. January 3rd.—Mr. W. J. Harrison, F.G.S., gave a very instructive lecture on "The Uses of Geological Knowledge." January 19th.—Mr. C. J. Woodward, B.Sc., read a paper on "The Wave Theory of Light," and various experiments illustrating phenomena of polarised light were shown, and Fresnet's theory applied to the explanation of them. To elucidate the view that plane elliptical and polarised light may be conceived as made up of two vibrations at right angles to each other an apparatus was exhibited, consisting of two series of cranks, with rods at right angles to each other. By an adjustment of one crank in relation to the other, a wave corresponding to either plane elliptical or polarised light was obtained.

CHELTENHAM NATURAL SCIENCE SOCIETY.—December 16th.—Mr. G. B. Witts read an interesting paper on the examination of the "West Tump" long barrow, situated in the middle of Buckholt Wood, near Birdlip, Gloucestershire. Long barrows are regarded as of greater antiquity than round barrows. This particular one, strange to say, has remained unknown till the present time. The excavations commenced in August last and were carried on until November, when it became necessary to cover up the walls so as to protect them from frost. We hope to have the pleasure of printing in these pages Mr. Witts' account of his researches, and from what we know of them we feel sure our archæological readers will be greatly interested.

Plate IV.



Crystallisation of Water.

CRYSTALLISATION OF WATER.*

BY W. B. GROVE, B.A.

The sharp frosts of last winter and the preceding afforded us unusual opportunities of becoming acquainted with many of the phenomena of ice formation. It may not be known to all the readers of the "Midland Naturalist" that an amorphous, apparently structureless, block of ice is really a crystalline body; it is indeed by no means evident at first sight that such is the case. We know that, when a thin film of water crystallises on our window panes, strange and beautiful forms appear, amidst which we can often trace somewhat of regularity and the predominance of that angle of sixty degrees to which a snow-crystal owes its well-known outline, and we might conjecture *a priori* that the crystals of which ice is composed, could we but obtain them perfect, would be seen to be formed upon the same plan.

It was Professor Tyndall, I believe, who first showed indirectly that such is the case. Everyone who has read his lectures on "The Forms of Water,' or on "Heat as a Mode of Motion," will remember the beautiful experiment by which the intimate structure of ice is revealed. A slab of ice is cut parallel to the plane of freezing, and the concentrated beam of the electric lamp is sent through it. The heat melts the ice in parts, within the block as well as on the surface, the greatest effect being confined to a depth of about one inch. Each liquefied portion in the interior begins as a minute point, which as it enlarges assumes the shape of a six-petalled flower (Plate IV., Fig. 3;) the petals, at first rounded, become gradually more and more pointed and serrated, and at last approach some of the characteristic forms of snow-crystals. These liquid flowers are evidently the cavities previously occupied by those ice-crystals, which for some reason or other have yielded soonest to the influence of the transmitted heat.

If we wish to reproduce this effect ourselves, we have only to take a piece of clear ice, form it into a slab, the plane surfaces of which are parallel to the plane of freezing, (by sawing it, or by pressing each side alternately on a hot metal plate,) and then expose one of these surfaces to the warmth of a glowing fire. Hold it as close as the hand can bear, and in an instant the previously transparent ice is clouded with multitudes of minute bubbles (or what appear to be such) and, on

REFERENCES TO PLATE IV.

Fig. 1. Ice-crystal, formed on the surface of still water, natural size.
Fig. 2. Snow crystal, magnified.
Fig. 3. Ice-flowers, × 10.
Fig. 4. Hexagonal snow crystal, × 3.
Figs. 5 and 6. Liquid discs in ice, × 10.
Fig. 7. Composite cavity in ice, containing air and water.

* Read under the title "Some Phenomena of Ice," at a meeting of the Birmingham Natural History and Microscopical Society, March 16th, 1880.

removing the slab to a colder place and examining it through a lens, we shall see numbers of these ice-flowers within the slab, each with a "bubble" in the centre. Their diameter is usually about 1-10th to 1-20th of an inch, and they are only dimly visible, because the refractive indices of ice and water, at the freezing temperature, are nearly the same.

But what are these "bubbles?" Let us appeal to experiment for the answer. If we place a piece of ice containing them in warm water, we shall find that when the ice surrounding them is melted they suddenly collapse and disappear utterly. If we treat a bubble of air contained in ice in the same way, we shall see the bubble rising through the water as soon as it is liberated. Hence we infer that this apparent bubble, which occupies the centre of the ice-flower, is really a vacuum. Now observe how unexpectedly a law of nature steps in. Ice is less dense than water, as is manifested by its floating, and, when a certain quantity of ice is melted, the resultant water occupies a smaller volume : so the formation of each flower is attended with the formation of a vacuum.

This contraction of the volume of water, however, takes place in a peculiar way. When the cavity is small, and its sides close together, the molecules of water are able to bear the strain put upon them, and separate by a minute interval, so as still to fill the space. Thus the discs are at first bubbleless, but as the quantity of ice melted increases, the strain becomes greater, until at last the molecules yield to the influence of their mutual attractions, and rush together *suddenly* into a smaller space. Thus the formation of each vacuum is attended with a "clink" which is clearly audible, and resembles, on a smaller scale, the metallic clink heard when water deprived (as this ice-water is) of its dissolved air is shaken in a tube, as in Donny's well-known experiment.

The planes of these "negative" crystals, as they have been termed, lie in the planes of freezing, that is, in ordinary cases, parallel to the surface of the water. We may detect this direction in any block of lake-ice, taken at random, either by developing the flowers or by observing the bubbles which are almost invariably entangled in it. We shall see layers cloudy with bubbles, separated by layers of clear ice, the plane separating the two being, often, perfectly distinct on the lower side of the clear layer, but less so above. The explanation of this appearance is that the clear ice is that produced by slow freezing, *e.g.*, during the daytime, when the molecules of water, as they fall into their places in the crystal, have time to push out of the way the particles of air entangled among them. These collect into bubbles on the lower surface, and if, *e.g.* after sunset, a sudden fall of temperature takes place and the freezing becomes more rapid, they are unable to extricate themselves and become locked in their icy prison. It will be noticed that the bubbles, which would be normally nearly spherical, are usually pear-shaped or conical, with their longer axis vertical and the narrow end pointing downwards as if they had been gradually compressed laterally by the expansion of the surrounding water as it passed into the solid state. Larger bubbles are less frequently met with in lake-ice; these are probably filled with gases emitted from the decaying matter at the bottom, which we know is continually rising to the surface in bubbles when the water is unfrozen.

The ice made in freezing machines, or on a small scale in a test tube, is generally cloudy, being quickly formed. The reason why slowly-formed ice is transparent is that the crystals are in perfect optical contact, but it is said to be possible, by carefully exposing a block to the action of heat, to cause it by a smart blow to fall into pieces which are roughly hexagonal prisms. This, however, I have not been able to do when I tried, but I once did something like it involuntarily. The winter before last, when I was skating at the Edgbaston Reservoir, I lost my balance and fell. The ice cracked ominously, and on rising I saw the spot where I had come in contact with it marked by a large six-rayed star, the arms of which were from twelve to eighteen inches long, and arranged almost exactly at equal angles of sixty degrees, like the main rays of the crystals (Figs.1 and 2.) I also produced the same effect last winter in a water-tub by striking the ice with a hammer, the rays being longer or shorter according to the strength of the blow. It seems probable that the ice cracked in these directions because these were the planes of least resistance, like the planes of cleavage in crystallised minerals.

It is interesting to see ice thus analysed, and its component parts demonstrated, but it is still more interesting to observe the synthetic process, by which the crystals are formed. This is in general so masked by various circumstances that they rarely assume their proper shapes, but under special conditions perfect crystals may be obtained. They have been noted by several observers, but are undoubtedly of comparatively rare occurrence. I am pleased therefore to record the fact that, one morning in December, 1879, I found floating freely on the surface of a basin of water, in my house, three thin plates of ice, the smallest but most regularly formed of which is represented in Fig. 1 of its natural size, about two inches in diameter. It will be seen how closely it imitates the form of the snow-crystal which is sketched above (Fig. 2.)

The main conditions necessary for the formation of such crystals seem to be intense cold, combined with slow freezing. Professor Tyndall, to whom I am indebted for many of these facts and explanations, observed the formation of little six-rayed stars of thin ice in the vessel of an artificial ice machine, in which the action was proceeding very slowly. He believed the observation to be then new, and it gives me, therefore, great pleasure to quote the following account of a similar occurrence described in a letter to me by Mr. W. H. Wilkinson. He says that it happened on a Christmas-day, some years ago, when the thermometer in Birmingham fell below zero :—

"In my greenhouse there was an aquarium, some 5ft. long, with about 6in. deep of water in it.

"The doors being closed, the temperature was prevented from falling below 32° during the night, but early on the morning of Christmas-day, as I entered, the cold air rushed in ; and my attention was first called to the intensity of the frost by the fact that some water, accidentally spilt, was frozen solid before I had time to walk the length of the greenhouse.

"On looking into the aquarium to see how the fish stood the cold, my attention was attracted by some little stars rising from the sides and bottom, and floating up steadily to the surface of the water. They sometimes came up singly, and sometimes in clusters of two or three or more.

"They at first formed little islands of ice on the surface, by joining together at their points; others rising under them soon filled up the spaces, and formed thin sheets of fragments of ice, with rough, jagged edges.

"In a short time the entire surface was covered with ice, and in the course of a few hours the aquarium was frozen solid."

Before concluding, I must refer to two other phenomena, which anyone, who tries to reproduce the ice-flowers, will probably meet with. Sometimes, instead of liquid flowers, we get only liquid discs, that is, extremely thin layers of water, which are unattended by a "bubble." I have seen these discs hexagonal, instead of circular, (see Figs. 5 and 6,) presenting a close resemblance to the hexagonal plate snow-crystal which is frequently seen. Their average diameter is the same as that of the flowers, and they also lie in the plane of freezing. If, instead of the ice being perfectly clear, it contains bubbles of air, then, on exposure to heat, we shall find the portion of ice immediately surrounding the bubble to melt. Thus we obtain composite cavities, as drawn in Fig. 7, where the central bubble represents the air, and the clear area surrounding it the water. The cavity occupied by the water does not, in this case, generally assume the form of an ice-crystal. It is usually rounded, but sometimes slightly crimped at the edges. Since the ice in melting shrinks to a smaller volume, it follows that the air composing the bubble must now be rarefied ; and this is confirmed by observing that when the ice surrounding it is melted, and the bubble set free, it invariably collapses to a much smaller size.

The question arises, why should the ice melt immediately around the bubble in preference to any other part? The answer to this question depends upon an interesting property of the particles of matter. We know that a liquid in its ordinary condition is continually giving off vapour from its surface; but why from its surface only? Simply because the molecules there have greater freedom of action, are less hampered by the surrounding molecules than those within the body. So, in a mass of ice, the particles on the surface yield to the influence of the heat sooner than those within the mass. But it is obvious that the particles in immediate contact with an enclosed bubble are, in this respect, in circumstances similar to those on the exterior of the ice. The heat of a body is at the present day attributed to a motion of the molecules composing that body. When the motion of the particles of a solid reaches a certain limit, the solid becomes a liquid; when the motion is further increased, the liquid becomes a gas. And we can easily see that a molecular motion, which is incapable of liberating the particles of a solid mass, may be propagated through them without prejudice to its solidity; yet, when this same motion reaches the particles bounding a cavity, it may suffice to liberate them. Professor Tyndall, from whom I have derived this explanation, made a number of experiments, which entirely confirm it; and those who have studied his theory of glacier motion know that the same idea has been applied to explain the effect of regelation upon which the theory is based.

There is one other point of view in which the ice-flowers teach us a lesson. Why should one portion of a solid block of ice melt sooner than another? The heat which liquefies these flowers must have passed through the surrounding ice before it reached them. We conclude, to quote Professor Tyndall's words, that "the absorption is fitful, and not continuous; and there is no reason to suppose that in other solids the case is not the same, though their constitution may not be such as to reveal it. There is no such thing as absolute homogeneity in nature. Change commences at distinct centres, instead of being uniformly distributed; and in the most apparently homogeneous substance we should discover defects, if our means of observation were fine enough."

THE FLORA OF WARWICKSHIRE.

AN ACCOUNT OF THE FLOWERING PLANTS AND FERNS OF THE COUNTY OF WARWICK.

BY JAMES E. BAGNALL.

(Continued from page 38.)

Previous Records of the Warwickshire Flora.

The following short sketch of the progress of botanical investigation in Warwickshire is as complete as my knowledge of this subject will allow.

The earliest records of Warwickshire plants with which I am acquainted are those of our great English naturalist, John Ray, or Wray. As this eminent botanist spent several years in the county, at Middleton Hall and Sutton Coldfield, it might have been expected that his records from Warwickshire would have been more ample than we find them. From an observation of his, prefacing his list of Warwickshire plants, in Bishop Gibson's edition of "Camden's Britannia," we may conclude that he had not a very high opinion of the floral riches of the county. He says: "Though I have lived for some years in this county, yet have I met with no peculiar plants growing therein." His earliest notes are to be found in his itineraries. Under the date of May the 8th, 1662, he says: "From Northampton we rode through Hill Morton and Rugby to Coventry, thence to Coleshill, and then to Middleton. On a bank by the wayside we found a kind of vetch, with a bright purple flower. Monday, May the 12th, we rode out to Sutton Cofield, where is a close called the Park Close, belonging to the free-school. Here we found *Lunaria minor* (*Botrychium lunaria*, Sw.) in great plenty." In his correspondence, in a letter addressed to Mr. Lister, dated Middleton, Nov. 15th, 1669, he also mentions two or three more plants, namely, *Empetrum nigrum*, *Alchemilla vulgaris*, and *Polygonum Bistorta*, as occurring near Middleton.

In 1670 Ray published his "Catalogus Plantarum Angliæ, &c.," in which he gives stations for a few of the more rare plants of the county, chiefly from the neighbourhood of Dosthill, Tamworth, and Middleton. These will be noticed in their proper places. Edition 2, 1677, Mr. Newbould informs me, does not seem to differ from Ed. 1, so far as Warwickshire is concerned.

In 1695 Bishop Gibson published his 1st Edition of "Camden's Britannia," in which on pp. 515-516 he publishes a list compiled by Ray, headed thus: "More Rare Plants growing wild in Warwickshire." In this list stations are given for about fourteen of our more local plants. The various editions through which this work passed contained this list without verbal alteration.

"Magna Britannia et Hibernia," Vol. V., pp. 879-80 (1730) contains the above information in an abridged form.

"Gough's Camden's Britannia," Vol. II., p. 350 (1789) has the above, with three or four additional plants. This list is headed, "Rare plants in Warwickshire."

Some of these plants are still to be found in the stations given by Ray; others, however, notably *Osmunda regalis*, appear to be missing.

In 1776 Withering published the first edition of his "Systematic Arrangement of British Plants," in which may be found Warwickshire stations for several of the more rare species. Among the flowering plants these records are few and far between. His attention was, apparently, mostly devoted to the Fungi, of which he records a fairly good list. In the later editions of the above work few alterations are to be observed. As Withering lived for many years at an easy distance from Sutton Coldfield it is somewhat remarkable that he should give so few of the plants special to that locality.

In 1805 Turner and Dillwyn published "The Botanist's Guide through England and Wales." In Vol. II., pp. 633-637, is a list of about forty-five of the rarer plants of Warwickshire, given on the authority of Ray, Withering, and eminent botanists then living. The copy I have of this work formerly belonged to Professor J. Power, a native, I believe, of Atherstone. It contains many MS. notes on the botany of the county, signed "J. P.," but only in rare cases dated. These I shall quote in their proper sequence.

The most complete record of the Flora of Warwickshire is that of Thomas Purton, Surgeon, Alcester, in the "Midland Flora," 2 vols., dated April 13th, 1817, and Vol. III., with supplements, 1821. In these volumes the Warwickshire habitats of the rarer plants are usually given; and these records have in most instances been confirmed by myself in later years. The more common plants are, however, rarely localised, being merely recorded as "common," "frequent," "not rare;" and as this is professedly a mixed Flora, it is not safe to decide to which county in the Midlands these remarks apply. I have only quoted those records that are duly localised. Purton was an eminent botanist in the early part of the present century, and was especially an authority of repute as a fungologist.

In 1817 W. G. Perry, an able and earnest botanist, residing at Warwick, published in the abridged edition of "Dugdale's Warwickshire," pp. 591-594, "A Select List of Plants Found in Warwickshire," dated July 5th, 1817. Many of these records have apparently been copied from Purton's then recently published "Midland Flora." In 1820 Mr. Perry published the "Plantæ Varvicenses Selectæ," or "Botanist's Guide through the County of Warwick," in which is a list of 380 of the more rare plants found in the county. This work is compiled mainly from Ray, Hudson, Withering, Turner, Purton, Sowerby, &c., with a few notes from the Rev. W. T. Bree, of Allesley, and many records from the compiler's own note book.

During his life Mr. Perry collected, from various sources, a valuable collection of plants; among these an extensive collection of Warwickshire plants. This collection, at his death, became the property of the Warwick Museum. To this collection many local botanists contributed; some of them, notably W. Cheshire, Thomas Kirk, and Henry Bromwich, excellent and critical botanists.

In the "Magazine of Natural History," Vol. III., pp. 162-167, (1830,) the Rev. W. T. Bree, Rector of Allesley, contributed an excellent paper on the "Rarer Plants found in Warwickshire." Most of these are on his own personal observation, and are principally records from the neighbourhood of Coleshill and Allesley." In the subsequent volumes of the same work occasional notes from the same botanist occur.

In 1835, Mr. Hewett C. Watson published his "New Botanist's Guide to the Localities of the Rare Plants in Britain," and in his preface he says: "I am indebted to the Rev. W. T. Bree for a checked catalogue of the plants of this county, (Warwickshire,) chiefly from Allesley and Coleshill. These records are given pp. 181-187, and are mainly those already recorded in the work last mentioned. In 1837, Vol. II. of this work was published; and in the supplement, pp. 611-616, are more records from the county, on the authority of the Rev. W. T. Bree and the Rev. Andrew Bloxam.

In "The Analyst," Vol. VI., pp. 20-28, (1837,) W. Ick published a paper, entitled, "Remarkable Plants Found Growing in the Vicinity of Birmingham in the year 1836." This is a record from the neighbouring counties, Worcester and Stafford, as well as from Warwickshire, and, although it adds no new plants to the Flora, it gives new stations for some of the more rare ones. The list of plants is prefaced by some good, practical remarks. I owe my knowledge of this paper to the kindness of the Rev. W. W. Newbould, who copied it *in extenso* from the copy in the British Museum, marked PP. 5850.

In June, 1841, that valuable and interesting botanical journal, "The Phytologist," was commenced. In the earlier volumes several contributions will be found, bearing upon the botany of Warwickshire. On page 15 of vol. I. are some incidental notes on rare plants, observed in Sutton Park, by George Luxford. A much more extensive list occurs in a paper published in July, 1842, pp. 261-2, entitled "A List of the Rare Plants observed in the neighbourhood of Birmingham," and signed Samuel Freeman, Sun Street, Birmingham. I was not aware of the existence of this paper, when I published my "Notes on the Flora of Sutton Park," or I should have given to this botanist the credit he deserves.

Among the more valuable contributions to the "Phytologist," having reference to the matter in hand, are the following :—

"Notice of a few of the rarer Warwickshire Plants," by Thomas Kirk, Coventry, Vol. II., pp. 969-72.

"Localities for some of the rarer Plants of Warwickshire," by Rev. Andrew Bloxam, M.A., Twycross, Vol. III., pp. 324-5.

"County Lists of the British Ferns and their Allies," compiled by Edward Newman, (Warwickshire,) Vol. I., pp. 510-12.

"Localities for Botrychium Lunaria." By W. Thickens Keresley, 1848, Vol. III., p. 223.

"Warwickshire Habitat for Gagea lutea." By Rev. W. T. Bree, Vol. III., p. 922.

"A Visit to the Lily Field." By Rev. W. T. Bree. Vol. III., p. 945.

And in other volumes are incidental notes by Kirk, Cheshire, and other botanists.

In 1869 and 1870, the Birmingham Natural History and Microscopical Society published in their volumes of Proceedings, "*Lists of the Flowering Plants, Ferns, Mosses, and Hepaticæ indigenous to the neighbourhood of Birmingham.*" These lists were compiled by myself, and the localities given are mainly Warwickshire ones. As I had then no knowledge of any of the past records above mentioned, these were necessarily unnoticed. These lists are very incomplete, having been published when my experience was limited, and have, among many other faults, that of being a mixed Flora.

In 1874 the Warwick Natural History and Archæological Society published in their Proceedings, "*A Catalogue of Plants Collected in Warwickshire.* Compiled by the Rev. J. R. Young and R. Baker, M.D."

By the kindness of Canon Young, I was allowed to revise the proof sheets of this catalogue, and to make many additions. This list is a record of the observations of the compilers, the Rev. A. Bloxam, Henry Bromwich, the Rugby School Natural History Society, and myself, and is the most complete list yet given of the plants found in Warwickshire since the publication of the Midland Flora. The above was afterwards issued as a separate publication, and is, I believe, still to be had.

In the various reports of the Rugby School Society, published from 1867 to 1879, valuable information has been given on the Flora of that part of Warwickshire immediately around Rugby. Many of the botanists of this Society were good and reliable ones, and as they had until recent years the constant aid in all difficult matters of that most able, amiable, and courteous of Warwickshire botanists, the Rev. Andrew Bloxam, these lists are of permanent value. By the kindness of Mr. Trott, such volumes as were not in my possession were forwarded to me, and I have availed myself of the information contained in these freely.

In 1877, the Rugby School Natural History Society published a very complete register of the flowering plants and ferns, from observations extending over five years, which will be quoted with other reports as occasion serves.

In 1877, the Birmingham Natural History and Microscopical Society published "Notes on Sutton Park and its Flora," to which is added "The Rubi and Rosæ of Warwickshire," by James E. Bagnall. In this, all the plants, both rare and common, to be found in this portion of the county were noticed.

In Mr. Hewett C. Watson's "Topographical Botany," and also in "The Compendium of the Cybele Britannica," by the same author, many references occur relative to Warwickshire plants. Besides the above-mentioned works, occasional notices, bearing on the Flora of this county, have appeared in the "Journal of Botany—1863—1880;" but no paper of any great importance occurs on the flowering plants. The yearly reports of the London Botanical Exchange Club and of the Botanical Record Club both contain notices of plants collected in this county.

(To be continued.)

A PICTURE IN THE KOSMOS.

The evening of the 31st of January, 1881, will long be remembered by all hereabouts who delight in the beauties of creation. A barometric trough from the Atlantic was passing briskly away to eastward, with gentle westerly airs, veering west-north-west, playing round its southern side, resulting in clearing skies, air becoming drier, diathermancy increasing; hence free radiation and a crisping soil. Low in the romantic gorge of the Churnet, however, a thick white fog-band was heaving and swelling, nurtured as it were by the cold air pouring down from the watersheds, and condensing the vapours reeking from the river. Towards the pine-clad crests of the old Bunter Beds, just beyond, the crescent moon was bending; and so clear was our atmosphere above, that, notwithstanding its oblique thickness, the other parts of her voiceless tracts, bathed in the pale reflected light of earth, were thrown out against the shadowing twilight in a relief strikingly bold and strange to the eye; and the telescope showed up the low-lying plains in black contrast with the higher regions reflecting again the earthshine. Venus, in her increa ing loveliness, following as though in the wake of our satellite, with Jupiter and Saturn in the rear, formed a panoramic picture in our System of exquisite beauty:—soulless indeed must have been he who did not pause and admire. Soon, about 6 15, a bright glow appeared in the north-west sky, spreading over in an elliptical patch past Cygnus, developing next a nucleus of a purple tint, and throwing out ultimately a branch of auroral light towards Venus. Next the whole northern sky became lit up with an electric glare, and about 6 30 a magnificent aurora streamed from the horizon, yet in fitful pulsations, giving out detached quivering patches to the zenith, and even beyond Capella. I was now in the valley; but on ascending the opposite hill, a bank of dark slaty purple, low in the northern sky, became distinctly visible, and from it the streamers shot up towards the zenith, now with a steady glow, the next moment to shoot back—a few tremulous throbs and detached cones of fluttering light—and again the rays would burst forth, skimming the heavens in all their splendour. The nucleus of the display was soon seen to be about the magnetic pole, though the rays shot up from below Regulus to the vicinity of Altair, and a diffused gleam of light marked even the south-west sky. Near seven o'clock the display faded, but patches and sheaves of lustre still flickered in the north-west, and a spreading light-flush lingered for long in that quarter.

* * * *

That auroral displays result from magnetic disturbances due to increased action in the sun there can now be but little doubt. I am in the habit of scanning the sun's face daily when fine, with a 2⅜in. clear aperture, and my notes, so far, certainly point to the auroral light being cotemporary with an increase of spots. On the morning of the 1st February, after the aurora, five main spot regions were noted, viz.:—two centres approaching the west limb, with both *umbræ* and *penumbræ*, split up portions and stipplings; a broken up group further north, an isolated spot near the sun's centre, and a most interesting group in perspective with *faculæ*, very marked, coming up on east limb; indicating, doubtless, gigantic storms; and an awful, roaring rush of currents, of which the imagination can form but a faint idea, piercing and tearing asunder the gaseous envelopes, and heaping up the photosphere around the disturbed areas.—Clement L. Wragge, Farley.

ON THE GRITS AND SO-CALLED SANDSTONES OF THE LOWER AND MIDDLE SERIES OF THE BRISTOL COALFIELD.

BY EDWARD WETHERED, F.G.S., F.C.S.

Continued from page 29.

The next deposit, then, is the Holmes grit, which is the base of the middle series of the coal measures, and was for some time considered to be the Millstone grit faulted up in the southern part of the district. By reference to the section of the Coalfield, the seriousness of such an error becomes apparent, as the whole of the lower series of Coal Measures would be unknown in that particular part of the district. It was, too, considered to be identical with the Hard Venture grit. By comparing the analyses of these various deposits, the similarity of chemical composition renders the mistakes excusable if simply lithological features are relied upon. The following are the analyses of two specimens of typical Holmes grit, taken several feet apart:—

Analysis of the Holmes Rock.

	No. 1.	No. 2.
Silica	94·80	94·93
Alumina	3·60	2·05
Iron	·70	·52
Lime	·40	·86
Carbonaceous Matter	·70	1·00
Carbonic Acid	..	·60
Magnesia	Trace.	..
Water	·44	·43
	100·64	100·39

Passing over one or two succeeding deposits of grit, marked in the section of the Coalfield, we come to the principal rock of the district, namely, that of the well-known Pennant grit, or, as it is generally termed, Pennant sandstone.

The Coalfield has usually been divided into three divisions, the middle or Pennant grit series dividing the lower from the upper. It would be almost better to leave out the term Pennant series, as it gives rise to a mistaken notion as to the thickness of the actual Pennant. On referring to the section of the Coalfield the construction of the middle series is shown. It consists of several thick beds of grit, the thickest of which is the Pennant, hence the name Pennant series. For this reason the thickness of this grit has been placed, by some authors, at 2,000 feet, the thickness of the entire middle series, whereas it is only about 970 feet.

I am unable to give the origin of the name Pennant, but the term is applied to other beds in the district besides these just referred to. This, I submit, is justifiable, if the term is to denote a particular class of rock: the Doxall grit, for instance, is a Pennant so far as chemical composition and lithological features show. For the first 50 feet of the Pennant it is a very coarse stone, and contains 90 per cent. of silica. Following this a better class of rock commences, viz., that which is so extensively worked round Bristol for building and ornamental purposes.

ANALYSES OF THE PENNANT GRIT.

	No. 1.	No. 2.	No. 3.	No. 4.	No. 5.	No. 6.	No. 7.
Silica	89·20	87·20	83·26	89·73	84·90	83·13	85·30
Alumina	5·10	4·40	2·26	2·33			
Iron	2·57	3·13	6·16	2·85			
Lime	·75	1·26	2·80	1·33			
Organic Matter....	1·25	1·45	3·25	1·29			
Carbonic Acid	·75	2·75	1·15	1·50			
Magnesia...........	·07						
Water	·45	·65	·70	·75			
	100·14	100·84	99·58	99·78			

Reviewing the whole of the analyses given of the grits, we appear to have two varieties of arenaceous rocks, viz., the Millstone grit type and the Pennant, and through the whole of the series of coal-measures we get a repetition of these. The Pennant is lithologically distinguished by a blue colour, though at times a bed is met with strongly coloured with sesqui-oxide of iron, which imparts a red tinge, and is sometimes micaceous, which I have not observed to be the case with the other grits.

It is then at the risk of serious error that we attempt to judge of horizons by the lithological features of these rocks, and I take it that what will apply to the Bristol Coalfield will also to others. The proportion of silica in the Hard Venture and Holmes grits seems to be constant in typical beds of the rocks,* and even in that of the Millstone grit. This I consider may be used as a test, especially over a small area, but no great amount of reliance can be placed in it apart from other evidence.†

The mention of mica in the Pennant variety will raise surprise at the non-mention of alkalies in my analysis. I can only say that I have failed to detect them, and I account for their absence by supposing that these rocks have all been subjected, to the action of carbonic acid (the percentage of carbon which they contain is a proof of this.) This being so, the alkalies would be the first to be attacked, forming soluble carbonate, and, as the rocks are very porous, they would be removed in solution.

Reverting now to the changes which take place when the grits are in contact with carbonaceous matter, the result would appear to be that the percentage of silica is decreased, and of alumina increased, while manganese, sulphur, and phosphorus appear. With a view of

* It is, of course, most important that only typical specimens of the rock be examined in such a test as this.

† As the Hard Venture and Holmes grit contain the same proportions of silica, of course other means would have to be adopted to distinguish one from the other.

investigating this matter further, a section of a quarry was taken, and each bed analysed. This is shown in section No. 2.

No. 2.—Section of a Pennant Quarry.

No. I. Bed.	Strata.	Thickness.	Chemical Composition.	Soluble in Acid.	Insoluble in Acid.	Total.
V.	Paving Stones in Bed of from 1½ to 2 inches thick.	2′ 0	Silica	..	..	89·73
			Alumina	·83	1·50	2·33
			Iron	2·26	·59	2·85
			Lime	·36	97	1·33
			Carbon	..	..	1·29
			Carbonic Acid	..	..	1·50
			Water	..	..	·75
IV.	Stone mixed with carbonaceous matter, the latter not in layers.	2′ 8″	Silica	..	..	77·53
			Alumina	4·30	1·36	5·66
			Iron	2·93	..	2·93
			Lime	4·53	..	4·50
			Carbon	..	..	4·60
			Carbonic Acid	..	..	3·60
			Magnesia	..	..	Trace.
			Water	..	..	·75
III.	Good Pennant.	12′	Silica	..	..	87·26
			Alumina	2·36	2·04	4·40
			Iron	2·33	·80	3·13
			Lime	1·26	..	1·26
			Carbon	..	..	1·45
			Carbonic Acid	..	..	2·75
			Manganese	..	..	·07
			Water	..	..	·65
II.	Inferior Pennant.	3′	Silica	..	..	83·26
			Alumina	2 26	..	2·26
			Iron	3· 6	2·80	6·16
			Lime	2·80	..	2·80
			Carbon	..	..	3·25
			Carbonic Acid	..	..	1·15
			Magnesia	..	..	Trace.
			Water	..	..	·70
I.	Alternation of beds of Rock, 2″ thick, with layers of carbonaceous matter of about the same thickness. Ground not pierced.		Silica	..	..	79·36
			Alumina	1·2	5·91	7·11
			Iron	3·16	..	3·16
			Lime	1·33	..	1·33
			Carbon	..	..	8 05
			Carbonic Acid	..	..	·90
			Manganese	..	..	·06
			Sulphur	..	..	·08
			Water	..	..	·70

Glancing at the section, we observe that beds No. 1 and No. 4 are the ones with which carbonaceous matter is visibly associated.

In bed No. 1 it is in stratified beds of about 1½ inches thick, which divide the stone into other beds of about the same thickness.

If we compare this bed with No. 5 we find that, with the exception of thickness, the physical conditions are very similar, but, with this difference, there is no carbonaceous matter between the thin beds of the latter. If, however, we examine the chemical combination of these two, we find a marked difference. In No. 1 the silica is 10·37 per cent. less than in No. 5. The alumina is 4·78 in excess ; and manganese and sulphur occur in No. 1. (Compare with Doxall.)

Now, if we compare beds Nos. 2 and 4, we find the physical conditions again similar, with the exception that there is visible organic matter mixed with No. 4, and we find the same thing applies to the silica and alumina as in the previous comparison. We may also compare bed No. 3 with No. 4 with the same result, but to a lesser degree. We should not expect to get so decided a difference when comparing No. 4,* as the carbonaceous matter is much less, and is not associated in the same way as in No. 1. In No. 4 it has the appearance of having been deposited with the sediment which formed the rock in No. 1 ; it is in stratified layers, the rock having been deposited over in alternate beds.

Now, if we take the analysis of those semi-argillaceous beds which occur over seams of coal and in coal-bearing strata called duns, we find that the same constituents are present as in the arenaceous rocks, *i.e.*, the grits, the chief difference being that there is more alumina in the former. This the following analysis will show :—

ANALYSIS OF SHALE AND DUNS.

	Shale from Holmes Quarry.	Duns from over Great Vein.	Duns from over Little Vein.
Silica	80·26	63·96	74·16
Alumina	8·93	13·86	12·00
Iron	2·09	1·60	5·13
Lime	1·00	1·43	·90
Carbonaceous matter	4·60	15·05	5·70
Carbonic acid	·50	·30	·60
Manganese	..	..	·10
Sulphur	..	Trace	Trace
Water	2·35	3·05	1·40
	99·73	99·25	99·99

Now, we have found that the grits when in contact with carbonaceous matter become more argillaceous, that is to say, the proportion of alumina is greater ; and if this process were to continue, rocks would be formed of the composition of shale and duns. Let us now see how this change has been brought about. My analyses have shown that the grits contain silicates, and there is no doubt that when first deposited they were in greater proportion ; we have then to consider what would arise if this rock-forming sediment was deposited with, or over, large masses of vegetation.

The vegetation would decay, and carbonic acid gas would be generated as one of the results. Now the effect of this gas on

* In the analysis of bed No. 4, the organic matter was scraped off the stone, so that the percentage of carbon given in the analysis is no guide as to the actual amount in the bed.

silicates is to decompose them, with the exception of silicate of alumina,* the bases forming soluble carbonates; but from the occurrence of hydrated oxide of alumina in nature † along with the silicate, a proof that it also undergoes decomposition under certain conditions. The alumina, however, is incapable of forming a carbonate, and the hydrated oxide of alumina formed is less soluble than the carbonates of the other bases arising from the decomposition.

It is then plain that the result of this action would be the removal of all silicates, with the exception of silicate of alumina, and thus the latter would increase in proportion to the whole, and where it is decomposed the proportion of alumina would increase owing to the insolubility of the hydrated oxide. This is just what we have found, and it appears to me to be conclusive evidence that shales, and those semi-argillaceous rocks which I have included under the name of duns, are formed from the action of carbonic acid gas upon arenaceous rocks such as the grits or the sediment of which they are composed.‡

One fact, which appears contrary to what we might expect, is the proportion of iron which remains in those beds which are in contact with carbonaceous matter. I would, however, point out that the iron is not in combination with silica, but exists as an oxide or carbonate, the natural product of the decomposition of the silicate. This fact, coupled with the presence of manganese, sulphur, and in one instance phosphorus, seems to show that carbonaceous matter has the power of secreting certain inorganic substances.

That this is the case with iron was demonstrated to me in the analysis of fossil Calamites from a bed of Pennant grit.

The following is the analysis :—

ANALYIS OF THE PENNANT BED IN WHICH THE CALAMITES OCCURRED.

Silica	87·60
Alumina	5·23
Iron	2·73
Lime	2·40
Carbonaceous matter	1·70
Carbonic Acid	..
Water	·90

ANALYSIS OF THE FOSSIL CALAMITE.

	Soluble in Acid.	Insoluble in Acid.	Total.
Silica	·73	6·36	7·09
Alumina	..	2·70	2·70
Iron	60·19	·53	60·72
Lime	2·27	·53	2·80
Carbonaceous matter			19·30
Carbonic Acid			·23
Magnesia			·86
Water			6·90
			100·60

* Bischof's Chemical and Physical Geology, vol. I., page 1. For the decomposition of silicate of iron see page 3.

† This we have found; the hydrated oxide of alumina being that portion soluble in acid.

‡ These rocks occur in coal-bearing strata, but apart from carbonaceous matter; still this is no argument against what I have said, as the carbonaceous matter may have been removed by decomposition.

The following analysis is that of carbonaceous matter, taken from the centre of a large sigillaria from a Pennant quarry at Frenchay.*

	Soluble in H. Cl.	Insoluble in H. Cl.	Total.
Silica	1·06	·83	1·89
Alumina	..	1·36	1·36
Iron	45·29	·50	45·79
Lime	9·40	Trace.	9·40
Carbonaceous matter			29·95
Carbonic Acid			4·45
Magnesia			·50
Water			6·55
			99·89

It will thus be seen that the percentage of iron in the fossil plants is very large, but that in the grit is only ordinary.

In conclusion I desire to return my thanks to Mr. Monks, jun., of the Easton Collieries, near Bristol, for the kind way in which he has supplied me with specimens of rock and necessary information.

COLOUR IN FLOWERS.

BY F. T. MOTT, F.R.G.S.

In the "Midland Naturalist" for 1879, (Vol. II., p. 175,) there is an article of mine on this subject, containing a theoretical explanation of vegetable colour, which has in it, I believe, some points of novelty. I have recently observed a phenomenon of plant life, which, as far as it goes, seems clearly to support that theory. I have had in my window during the winter a small hyacinth bulb, in a small vase of water. About three weeks ago this bulb had thrown up a flower spike six inches high in the centre of the usual whorl of leaves. The flowers expanded, but they were all quite *green*, as green as the leaves, and the bulb was thought to be a failure. It was left in the window, however, and a few days later the points of the perianth of the terminal flower were observed to be turning white. The change went on rapidly, and within a week seven out of the eight flowers in the spike had become pure white and fragrant, the eighth remaining green, but soon shrivelling up. This change of colour was accompanied by an equally rapid growth of tissue. The stalk shot up to nine inches, and the perianth segments, which had been about three-quarters of an inch long, and merely erecto-patent, elongated to an inch and a half, and became circinnately recurved.

I account for the phenomenon thus. The flower-spike had been thrown up in very dull weather and remained nearly in the condition of foliage. The last of the four secondary waves of vital energy

* The bed of sandstone from which this last specimen was taken I have not thought it necessary to analyse, as it was an ordinary Pennant.

—that which culminates in blossom—was checked and unable to develop itself. Then there came two or three sunny days; the conditions were changed and development went forward. The protoplasmic matter of the chlorophyll cells in the perianth was rapidly used up in the manufacture of new cellular tissue, and the supply being only sufficient for this purpose, the cells of that tissue were left empty, or filled only with a watery juice. Such tissue is necessarily white. Had the supply of protoplasm been larger, the surplus would have given colour to the perianth. But that it was not in the nature of that bulb to deposit an excess of protoplasm in the perianth was known beforehand by the papery whiteness of its outer scales.

METEOROLOGY OF THE MIDLANDS.
THE WEATHER OF JANUARY, 1881.

BY CLEMENT L. WRAGGE, F.R.G.S., F.M.S., ETC.

The month opened with fairly high pressure and a rise in temperature, the maximum value occurring at many of our Midland stations, (and in the N.-W. and S.-W. of England,) between the 1st and the 4th. The "great frost" set in generally on the 7th, being developed by the formation of a high barometric crest, and the establishment of a well-marked anti-cyclone in the northern districts with its attendant conditions. On the evening of the 7th the barometer gave way, and although depressions and the cyclonic type of weather followed, notably on the 12th and 18th, (the latter day being marked by terrific east-north-easterly gales and snowstorms that will long be remembered,) the frost still continued, fostered by the northerly and easterly winds travelling round the west and north sides of the depression-centres. The lowest temperatures occurred about the 15th, and several readings below zero were taken at our own stations. The rivers, canals, and brooks were in places hard frozen, and during a whole week the Trent at Nottingham could be crossed with perfect safety. A brisk fall of the barometer set in on the 24th, and at length, on the approach of a deep cyclonic ring from the Atlantic, temperature rose from depths below the freezing point; and, with light southerly winds circling round the east side of the depression, which crossed the Midlands on the 28th, followed in its wake by a deeper trough on the 29th, the great period of frost closed, having, by night frosts, lasted without break from the 6th, a period of twenty-three days. Hence, after the excessive cold, universal fog prevailed, the maximum temperature was registered at other Midland stations, and so the month closed. At Tenbury the mean temperature was 10·5 below the average, the lowest recorded in a period of more than fifty years. At Moseley this was the coldest month registered, there being no record of any so cold since January, 1820; the mean of twenty-one days, ending the 27th, was only 23·2. That the cold largely resulted from excessive radiation, is proved by the astonishing differences in temperature between hill and valley stations in close proximity. For instance, on the 17th, at nine A.M., the dry bulb at Oakamoor, in the Churnet Valley, read 3·6; at Farley, barely a mile distant, E. by S. on the left watershed of the river, and 290ft. above, the simultaneous reading was 16·4; and on Beacon Stoop, 576ft. higher than Farley, and but 2½ miles distant, the value at nine A.M. on the 17th was 20·7. Deficiency of ozone between the 7th and

STATION.	OBSERVER.	RAINFALL.				TEMPERATURE.			
		n. for M.	Greatest fall in 24 hours. In.	Greatest fall in 24 hours. Date.	No. of rainy d.	Greatest ht. Deg	Greatest ht. Date.	Great'st cold Deg	Great'st cold Date.
GLOUCESTERSHIRE.									
Stroud	S. J. Coley, Esq.	1·26	·35	19	9	47·0	30 & 31	6·0	15
Cheltenham	R. Tyrer, Esq., B.A., F.M.S.	1·20	s)·58	18	12	48·0	31	—3·3	20
WILTSHIRE.									
Marlborough	Rev. T. A. Preston, M.A.	2·68	1·67	18 & 19	10	48·8	31	6·9	15
SHROPSHIRE.									
Woolstaston	Rev. E. D. Carr	·64	·15	30	10	46·5	31	—1·0	26
Stokesay	M. D. La Touche, Esq.	·72	·19	18	8	48·4	31	0·9	21
More Rectory, Bishop's Castle	Rev. A. Male	·92	s)·35	18	9	46·0	2	3·0	15, 16, 25
Bishop's Castle	E. Griffiths, Esq	·76	·20	18	12	47·0	31	3·0	25 (26
Cardington	Rev. Wm. Elliott	·83	s)·42	18	8				
HEREFORDSHIRE.									
Stoke Bliss	Rev. G. Alexander	·32		18	7	46·0	2	12·0	14, 20, 21
WORCESTERSHIRE.									
Orleton, Tenbury	T. H. Davis, Esq., F.M.S.	·65	·20	18	11	47·5	31	4·3	22
Moseley, Birmingham	Thomas L. Plant, Esq.	1·18	s)·50	18 & 19	7	47·0	1	3·0	23
West Malvern	A. H. Hartland, Esq.	·83	·36	26	7	44·0	29	10·5	24
Pedmore	E. B. Marten, Esq.	·72	s)·13	19	10	46·0	31	1·0	21
Dennis, Stourbridge	C. Webb, Esq.	·36	·10	30	11	47·0	31	5·0	14
Stourbridge	J. Jeffries, Esq	·65	s)·22	19	5	47·0	2 & 29	4·0	14
STAFFORDSHIRE.									
Kinver	Rev. W. H. Bolton	·46	s)·11	18	10	45·0	1	7·0	14 & 21
Walsall	Mr. N. E. Best	·48	s)·11	19	9	43·0	1 & 2	9·0	14, 15, 21
Lichfield	Mr. J. P. Roberts	·57	s)·25	19	5				(24
Grammar School, Burton	C. U. Tripp, Esq., M.A.	·87	s)·25	18	13	45·0	31	4·0	15 & 16
Weston-under-Lyziard R'tory	Hon. and Rev. J. Bridgeman	·43	·10	11	10	47·	2	3·0	15
Wrottesley	E. Simpson, Esq.	·43	s)·08	11	8	45·6	3	4·3	16
Barlaston	W. Scott, Esq., F.M.S.	·43	·25	28	8	46·0	31	—4·6	15
Tean	Rev. G. T. Ryves, M.A.	·50	·09	11 & 29	10	46·4	31	5·0	17
Heath House, Cheadle	J. C. Philips, Esq., J.P.	·89	·10	29	8	45·0	2 & 31	10·0	16, 25, 26
Oakamoor	Mr. E. E. Kettle	·59	s)·12	11	8	46·8	2 & 31	3·1	16
Farley, near Cheadle	C. L. Wragge, Esq., F.M.S.	·42	·09	29	8	47·1	4	10.6	25
Beacon Stoop, Weaver Hills	C. L. Wragge, Esq., F.M.S.	·43	s)·16	11	8	49·0	2	7·7	26
Alstonfield Vicarage	Rev. W. H. Purchas	·49	·13	26	8	4[illegible]·5	2	3·2	25
WARWICKSHIRE.									
St. Mary's College, Oscott	R. Pate, Esq.	·65	·18	18	10	48·0	31	7·6	25
Henley-in-Arden	T. H. G. Newton, Esq.	1·10	s)·40	18	9	47.0	31	4·0	15
Leamington	J. Goodacre, Esq.	1·43	s)·72	18	11	49·0	4	3·4	2[illegible]
Coundon, Coventry	Lieut.-Col. R. Caldicott	1·19	s)·50	18	10	48·0	30	9·0	14
Bickenhill	J. Ward, Esq.	1·14	s)·42	18	6			10·0	
DERBYSHIRE.									
Stoney Middleton	Rev. U. Smith	·41	·23	27	2	45·0	2	3·0	19
Fernslope, Belper	J. G. Jackson, Esq.	·61	·11	12	8	46·0	2	9·0	15
Spondon	J. T. Barber, Esq.	·51	·12	12	8			2·0	
Duffield	W. Bland, Esq.	·56	·13	12	11				
NOTTINGHAMSHIRE.									
Trent College		·69	s)·25	18	8	49·0	3	1·0	14
Park Hill, Nottingham	H. F. Johnson, Esq.	·66	s)·12	19	10	43·8	1	11·0	14
Hodsock Priory, Worksop	H. Mellish, Esq., F.M.S.	·66	·12	12	14	48·1	31	1·6	21
Tuxford	J. N. Dufty, Esq., F.G.S.	·70	·21	27	9	41·0	1, 4, 30	9·0	20
LEICESTERSHIRE.									
Loughborough	W. Berridge, Esq., F.M.S.	·60	s)·19	18	13	49·1	31	1·9	15 & 16
Syston	J. Hames, Esq.	1·47	s)·50	19	11	44·0	5 & 6	1·0	15
Leicester	H. Billson, Esq.	·72				44·8	31	6·0	15
Town Museum, Leicester	M. Browne, Esq., F.Z.S.	·59	·18	19	10	47·[illegible]	31	5·2	15
Ashby Magna	Rev. E. Willes	1·10	s)·60	19	10	45·0	30		
Kibworth	T. Macaulay, Esq.	·64	s)·17	18	11	44·0	30 & 31	11·0	13, 14, 21
Waltham-le-Wold	E. Ball, Esq.	1·06	s)·33	19	10	41·0	31	6·0	14
Coston Rectory, Melton	Rev. A. M. Rendell	1·19	s)·42	18	9	46·9	31	—2·0	16
NORTHAMPTONSHIRE.									
Towcester Brewery	J. Webb, Esq.	1·36	s)·50	18	12				
Castle Ashby	R. G. Scriven, Esq.	1·17	·50	22	9	48·0	30 & 31	5·0	21
Kettering	J. Wallis, Esq.	1·01	s)·30	18	12	44·0	31	13·0	21 & 22
OXFORDSHIRE.									
Ratcliffe Observatory, Oxford	E. J. Stone, Esq., M.A.	1·00	·25	20	13	48·7	31	6·8	22
RUTLAND.									
Northfields, Stamford	W. Hayes, Esq.	1·57	·50	19	7	45·0	30	1·0	15
West Deyne, Uppingham	Rev. G. H. Mullins, M.A.	·47	·12	29	12	46·0	31	9·5	16
OUTPOST STATIONS.									
Carlisle (Scaleby Hall)	R. A. Allison, Esq., F.M.S.	·91	s)·62	12	10	46·5	2	—7·0	26
Scarborough	F. Shaw, Esq., F.M.S.	1·38	·26	15	17	44·8	4	10·5	26
Blackpool (North Shore)	C. T. Ward, Esq., F.M.S.					44·2	1 & 2	7·4	15
" (South Shore)		·58	·19	16	8	45·0	1 & 2	—0·5	15
Llandudno	J. Nicol, Esq., M.D., F.M.S.	1·79	·62	15	10	48·2	29	14·5	26
Lowestoft	S. H. Miller, Esq., F.R.A.S.	1·07	·20	27	16	4[illegible]·0	31	9·2	15
Carmarthen	G. J. Hearder, Esq., M.D.	1·32	·26	26 & 28	12	50·3	31	3·8	15
Altarnun, Cornwall	Rev. J. Power, M.A.	2·[illegible]9	·50	29	14	50·0	1	3·0	26
Sidmouth	W. T. Radford, Esq., M.D.	2·27	·66	18	10	50·4	29	13·0	22
Ventnor	J. Codling, Esq.	3·23	·90	17	18	50·9	31	14·6	22
Ramsgate	Rev. T. Egan, O.S.B.	1·15	·32	27	15	4[illegible]·8	31	[illegible]	[illegible]

15th, and again between the 19th and 24th. Magnetic storm in P.M. of the 31st, and magnificent aurora about 6 40, which was well observed in the Midland districts. The amount of precipitation was generally but small, and in the moorlands of N.E. Staffordshire the snowfall was comparatively slight.

NOTES BY OBSERVERS.—*Woolstaston.*—Frost was of unprecedented severity here. Snowfall remarkably slight when contrasted with other places. *More Rectory.*—Apparently no record of such extreme cold in this neighbourhood. In lower situations thermometer fell below zero. *Bishop's Castle.*—Rainfall much less than the average. *West Malvern.*—Continuous frost from 5th to 26th, both inclusive. *Burton.*—Maximum on 25th, only 16·0. Twenty-five frosts on grass. *Weston-under-Lyziard.*—No great snowfall, but serious drifts. *Wrottesley.*—Minimum temperature lowest on record extending over forty years. *Tean.*—The snowstorm of the 18th did not reach this district. *Oakamoor.*—Ice-thickness in Churnet Valley on still water averaged 10 inches. *Farley.*—Lowest temperature of ground at depth of 1 foot, 28·5, 25th; at 2 feet, 32·4, 22nd; min. on grass, 5·2, 16th; max. in sun, 93·4, 23rd. No snow registered on 18th, but drifts 7 feet deep by walls. *Beacon Stoop.*—Climate of upper moorlands during the frost dry, genial, and salubrious, as contrasted with that of adjacent lowlands. *Alstonfield.*—Snowfall (11th to 19th) much smaller than in most other places. *Henley-in-Arden.*—Rainfall less than average of 10 years. *Leamington.*—Snowdrifts reported 12 feet deep. *Stoney Middleton.*—Month (especially latter end) very fine and clear. *Hodsock.*—41 hours of bright sunshine; max. in sun, 91·7, 21st; min. on grass −4·0, 16th. *Tuxford.*—Lowest "maximum," 18·0. *Loughborough.*—Max. in sun, 88·1, 31st; min. on grass, 0·9, 16th. *Kibworth.*—1st, Cowslip, Primrose, and Wallflower in bloom. *Coston.*—Snowstorm of 18th very severe. *Leicester* (Museum.)—Max. in sun, 85·5, 31st; min. on grass, 1·9, 22nd. *Kettering.*—17th, found Thrush starved to death. *Castle Ashby.*—Small Bat seen flying on evening of 3rd. *Uppingham.*—16th, the coldest day, having a mean temperature of 14·8. *Oxford.*—50 hours of sunshine. *Carlisle.*—The coldest month registered in 18 years. *Blackpool.*—Between 10th and 17th average daily temperature 18·6 below the mean. *Scarborough.*—Mean sea temperature, 40·8; coldest month on record (from 1866.) *Llandudno.*—Mean temperature, 7·1 below the average; coldest month since commencement of record (1861.) *Altarnun.*—Coldest month on record (commenced 1864;) one Snowdrop on bank, near brook, under trees, on 10th; a dozen others on 31st, after disappearance of the frost. *Sidmouth.*—The coldest month, with one exception, since 1837. *Ventnor.*—Weather has been very remarkable for its severity; heavy falls of snow, much drifted.

P.S.—Owing to the gales of the 18th and 19th, the amounts for "Rainfall" in those districts visited by the accompanying snowstorms *may* be incorrect. The values from Stroud, Stoke Bliss, Leamington, and Kibworth must especially be regarded with some caution.

Correspondence.

APPROXIMATE PHENOLOGICAL DATES.

As a guide to observers the Meteorological Society has drawn up the following table, giving approximately the times of appearance of plants, insects, and birds. In the case of plants, those persons who cannot observe the whole number are requested to pay especial attention to those of which the names are printed in capitals. Observers are respectfully requested to comply with the rules laid down in Messrs. Grove and Bagnall's paper at page 15 of the present Volume; and to send their notes and specimens as early each month as possible to Mr. W. B. Grove, B.A., Franchise Street, Perry Barr, Birmingham, who has undertaken to collate them.

MARCH.

Plants.

No. in List.	Average Date.		Earliest.	Latest.
25	1	*Potentilla Fragariastrum* (Barren Strawberry)	Jan. 18	April 7
36	3	*Petasites vulgaris* (Butter-bur)	Feb. 18	April 10
9	4	*Viola odorata* (Sweet Violet)	Feb. 16	Mar. 25
65		*Salix caprea* (Great Sallow)	Feb. 16	April 3
69	6	*Narcissus Pseudo-narcissus* (Daffodil)	Feb. 12	April 3
64	7	*Ulmus montana* (Wych Elm)	Feb. 5	April 1
8	9	*Draba verna* (Whitlow Grass)	Feb. 26	April 6
1	11	Anemone nemorosa (Wood Anemone)	Feb. 27	April 6
4	15	Caltha palustris (Marsh Marigold)	Feb. 14	April 13
57	20	*Nepeta Glechoma* (Ground Ivy)	Mar. 3	April 9
22	29	Prunus Spinosa (Blackthorn)	Feb. 20	April 16
61	30	Primula veris (Cowslip)	Mar. 19	April 7

Insects and Birds.

74 *Apis mellifica* (Honey-Bee.)
76 *Pieris rapæ* (Small White Cabbage Butterfly.)
79 *Trichocera hiemalis* (Winter Gnat.)
87 *Phylloscopus collybita* (Chiff-chaff) song begins.
90 *Corvus frugilegus* (Rook) builds.
86 *Phylloscopus trochilus* (Willow Wren) song begins.

Early Flowering.—On December 26th I found *Mercurialis perennis*, both male and female, several plants in full blossom. Station, borders of Beds and Herts; soil sandy, dry ditch, S.W. aspect. I could find, over many miles of country, only one other staminate spike, on January 16th. The first date is remarkably early, if it is not a remnant of late autumn growth. On January 29th, 1881, on a railway bank near the town, with a south aspect, I found several plants of *Tussilago Farfara*, in full blossom, about three or four inches high.—J. Saunders, Luton.

[Can any observer bring forward an undoubted instance of *M. perennis* flowering a second time in the autumn ?—Eds. Mid. Nat.]

Botanical Notes.—December 10th, 1880, at Frampton.—*Lamium purpureum*, in hedgerows; *Vinca minor*, var. *alba*, *Primula vulgaris;* Polyanthuses and Stocks in garden. December 27th.—*Viola odorata*, *Primula vulgaris*, at Frampton. January 4th, 1881.—*Bellis perennis*, at Gidding. January 7th.—*Ulex Europæus*, Helpstone and West Deeping; *Lamium album*, *L. purpureum*, *Capsella Bursa-pastoris*, *Geum urbanum*, West Deeping; *Linaria Cymbalaria*, *Senecio vulgaris*, Bamack.—January 13th to 29th, carpet of snow; February 3rd, *Galanthus nivalis* n garden at Frampton. February 9th, *Galanthus nivalis* and *Helleborus niger*, gardens around Peterborough. The wild plants above mentioned were collected in full flower at the various places named by J. W. Bodger, Peterborough.

Ornithological Notes from Oxfordshire.—The late severe weather has had a terrible effect on the birds. No less than ten green woodpeckers, besides five hawfinches and other birds were brought to Mr. W. Wyatt, of Banbury, about the end of the frost, all picked up starved. Kingfishers have also suffered very much, a great many were found in the Cherwell when the ice broke up. Wigeon have been scarce this season; I did not hear of any till December 30th. On the 5th inst., I flushed three short-eared owls from some long grass in a a wet marshy meadow. This very elegant bird is sometimes known here by the name of "Marsh Owl." On the 20th of last month I saw a hawfinch here, and I have heard of a good many more having been shot in the neighbourhood. A female golden eye was procured on the canal on the 18th, and on the 24th a grey crow was picked up near Banbury in a starving condition, and brought to Mr. Wyatt, who kept it for some days and then let it go. Hunger and cold had so tamed this wary bird, that it would take food from his hand.—Oliver V. Aplin, Bodicote, Oxon, Feb. 12th, 1881.

The Pupation of Melanthia Ocellata.—About the end of July last I obtained (from a female which I caught in Kent) some eggs of *M. ocellata*, which hatched on August 15th. The larvæ, which I fed on woodruff, grew but slowly; and instead of changing to pupæ in the following mon h, they went on feeding till November, when, finding that the food was no longer touched, I left them to themselves, they being then nearly full grown. Yesterday, February 11th, I examined the cage in which I had left them, and found several spun up in their webs, principally on the sides of a small box of earth which I had put into the cage, but not one had turned to a pupa; all were still in the larva stage, coiled up comfortably in their cells. This surprised me, as I find no record of any such occurrence with regard to this species in any of the recognised authorities on the subject. There are several species, *e.g.*, *Cirrhœdia xerampelina*, the larvæ of which remain for some time in the cocoon before changing into pupæ; but no one seems to have noticed anything of the kind with respect to *M. ocellata*. I write to invite the attention of midland entomologists to the subject, and to enquire if any of them can suggest a cause for this unusual state of things.—Chas. F. Thornewill, The Soho, Burton-on-Trent, Feb. 12th, 1881.

Gleanings.

Species of Birds.—Dr. Sclater states the number of existing (known) species of birds to be 10,139.

"A List of British Birds," with, as an appendix, "The Graduated List" for labelling eggs, has been compiled by Mr. Herbert W. Marsden, of Regent Street, Gloucester, and we advise our ornithological and oological readers to get copies. The price is sixpence. The list of birds has been carefully compiled on a plan which shows at a glance which are resident and migratory, and which are occasional or accidental visitors, the further information being added, as to which of the exotic faunas the last-named classes respectively belong to—Africa, America, Asia, or Australia. The authority for each scientific name is given, and it is also shown whether the authority is for genera and species, or for specific name only. "The Graduated List" for labelling eggs is also printed separately, on gummed paper, price sixpence. We have great pleasure in introducing these useful publications to our readers, and recommend them because they are meritorious.

Personal Statistics.—The following figures are *averages* for British males, between 23 and 50 years of age: Height, 68·84 inches; Weight, in lbs., 151; Chest girth, 35·79 inches; Strength of Arm, (*i.e.*, weight that can be lifted by right arm,) 97·49 lbs.

Crag Fossils.—The gentleman (Mr. W. Reed) whose munificence we have recorded above, possesses beyond doubt the finest collection extant of fossils from the Crag beds of Suffolk and Norfolk. Every new and rare species discovered in these newest Tertiary strata has for many years found its way to York.

Natural History Books.—A most competent judge (Dr. Gunther, of the British Museum) has recently estimated the cost of a complete natural history library at £70,000. Government has sanctioned the expenditure of half this amount for books for the new Natural History Museum at South Kensington.

Geology of Wales.—In the last Report of the British Association, (Swansea Meeting, 1880,) there is a list, by Mr. W. Whitaker, of 667 papers, books, maps, &c., by 279 authors, which have been written on the Geology of Wales, (including Monmouthshire,) up to the end of 1873. These lists are a great boon to local workers, whose best thanks are due to Mr. Whitaker for the great energy he has displayed in geological bibliography.

Kent's Cavern.—The exploration of this famous cavern, near Torquay, under the direction of a Committee of the British Association, from whose funds £1,850 has been contributed for the work, came to an end in June, 1880. One of the workmen, George Smerdon, was continuously employed from the first day to the last on the work. Employment in daylight must now seem strange to this honest fellow, of whom the Superintendent (Mr. Pengelly) speaks in the highest terms. During the last few months deeper excavations than had previously been attempted were carried on, but the basement deposit, called the Cave-Breccia, was continuous to the limestone floor of the cave, so far as the work was conducted, and contained flint implements—the undoubted work of man, in even its lowest level.

York Museum.—Mr. W. Reed, F.G.S., has purchased for £720, and presented to the Museum of the Yorkshire Philosophical Society, the fine collection of fossils, consisting of about 10,000 specimens, formed by the late Mr. E. Wood, F.G.S., of Richmond, Yorkshire. The collection is especially rich in carboniferous limestone fossils. Mr. Wood was an indefatigable worker, and will be remembered as the discoverer of a new genus of fossil crinoids, (*Woodocrinus*,) of which his collection contains many splendid examples.

Colour of the Eyes.—The iris, on which the colour of the eye depends, is a thin membranous structure composed of unstriped muscular fibres, nerves, and blood vessels, held together by a delicate network of fibrous tissue. On the inner surface of this membrane there is a layer of dark purple pigment, called the *uvea*, (from its resemblance to the colour of a ripe grape,) and in brown eyes there is an additional layer of yellow pigment on its outer surface also. In the albino, where the pigment is entirely absent from both surfaces of the iris, the bright red blood is seen through the semi-transparent fibrous tissues, of a *pink* colour. In blue eyes, where the *outer* layer of pigment is wanting, the various shades are due to the dark inner layer of pigment—the *uvea*—showing through fibrous structures of different densities or degrees of opacity. The eyes of new-born infants, of both white and black races, are dark blue, in consequence of the greater delicacy and transparency of the fibrous portion of the iris; and as these tissues become thickened by use, and by advancing age, the lighter shades of blue, and finally, grey are produced. In the various shades of green eyes, the yellow pigment is more uniformly diffused over the surface of the iris, and the green colour is due to the blending of the superficial yellow pigment with the blue and grey of the deeper structures. In the hazel and brown eyes, the *uvea* and the fibrous tissues are hidden by increasing deposits of yellow and brown pigment on the anterior surface of the iris, and when this is very dense, black eyes are the result. It is very doubtful, however, whether the iris is ever so dark-coloured in the inhabitants of this country as to justify the term black being applied to it, and the popular use of the expression has reference to the widely-dilated pupil, common in persons with dark-brown eyes. The nearest approach to a black eye, among us, is the dark-blue or violet eye, associated with black hair in some Irish adults; here the colour is probably not entirely due, as in infants, to the greater transparency of the fibrous structures, but to interstitial deposit of black pigment, or to a layer situated on the anterior surface of the iris.

Reports of Societies.

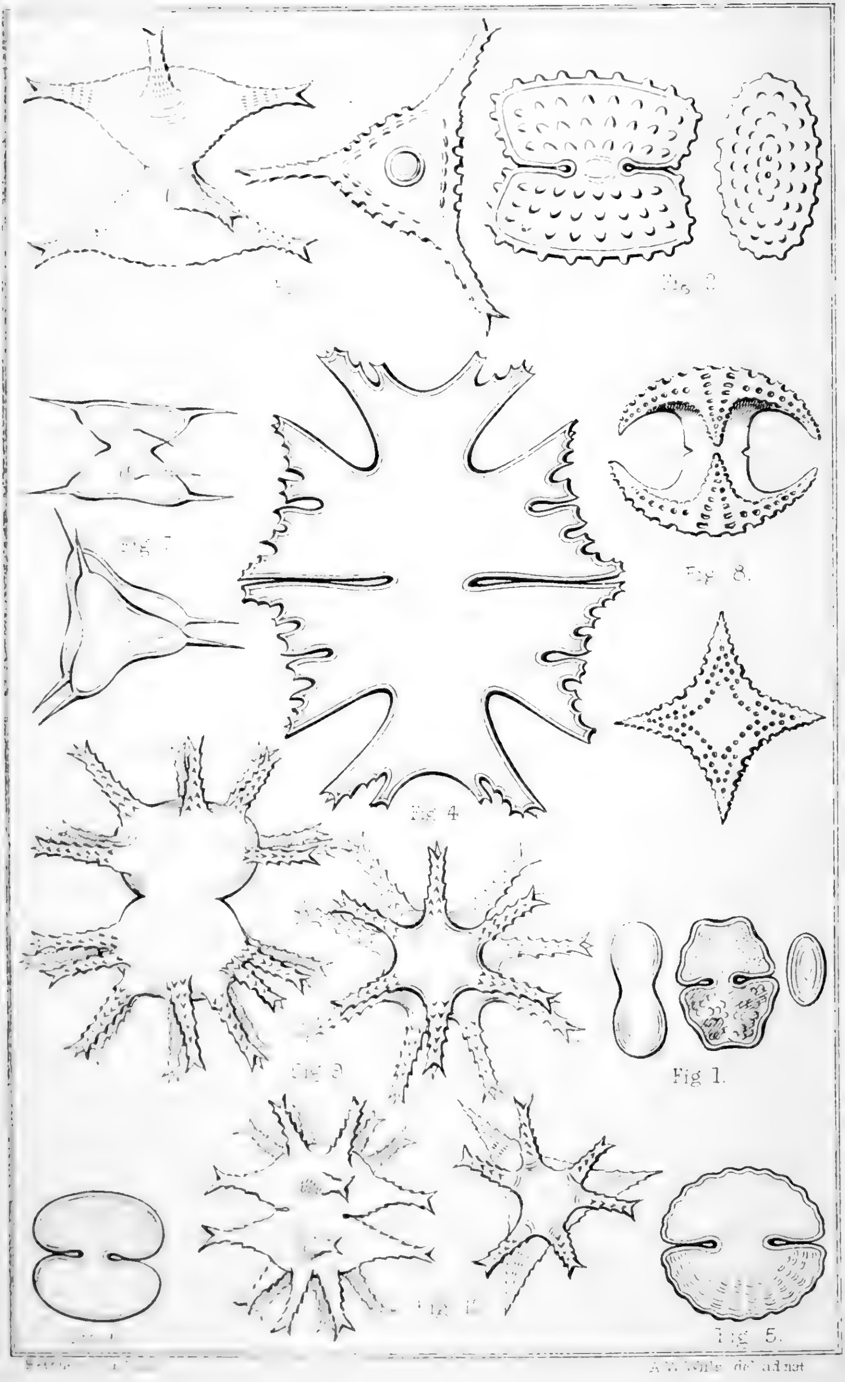
BIRMINGHAM NATURAL HISTORY AND MICROSCOPICAL SOCIETY.—Annual General Meeting.—February 1st. The Report and the Treasurer's Accounts for the year 1880 were read and adopted. The accounts showed a balance of £19 13s. 4½d. in the Treasurer's hands. The following officers were then elected for the ensuing year:—President, E. W. Badger; Vice-Presidents, John Levick, T. H. Waller, (ex-presidents,) W. R. Hughes, Edmund Tonks, Walter Graham, and W. Southall; Treasurer, Chas. Pumphrey; Librarian, Jas. E. Bagnall; Curators, R. M. Lloyd and H. W. Jones; Hon. Secs., John Morley and W. B. Grove. A vote of thanks was passed to Mr. H. E. Forrest for his past services as secretary. The newly-elected President then read a few remarks, addressed chiefly to the younger members, in which he urged upon them the duty of labouring and waiting, and promised to those who persevered an abundant reward. —Biological Section.—February 8th. Mr. A. W. Wills was re-elected chairman, and Mr. J. F. Goode secretary of the section. Professor Bridge exhibited a fine collection of specimens, preserved in spirit, which had been lately added to the museum of the Mason College. The collection, which was ably described by Mr. Ady, included three specimens of Zygæna, *Polyodon folium*, *Ceratodus Forsteri*, *Loris gracilis*, *Chitonellus*, *Ascidia*, Two-toed Sloth, Tamandua Ant-eater, and some stuffed birds and skins, presented by Mr. R. W. Chase. A cordial vote of thanks was unanimously accorded to Professor Bridge for his very interesting exhibition. Mr. R. W. Chase exhibited some remarkable specimens of the wingless birds, *Apteryx Australis* and *A. Oweni*. Mr. C. T. Parsons exhibited *Apteryx Oweni* and a specimen of the rare Owl Parrot. Mr. J. E. Bagnall exhibited *Polyactes cana*, a microscopic fungus, found growing on Sphagnum. Mr. W. F. Johnstone exhibited a small Toad, stated to have been found living in a cavity in a piece of coal. Mr. R. W. Chase read a paper on "The Migration of Birds." He said that the cause of migration was undoubtedly the desire for food, either for the adult birds themselves or for the young which they hoped to rear in this country. There seemed to be a double kind of migration going on; some birds that have bred in this country in the autumn go south, and return to us in spring, as the Swallow, Martin, Cuckoo, Swift, and Nightjar, &c.; while some arrive here in autumn and leave for the north in spring to breed, as the Fieldfare, Redwing, Grey Plover, Knot, &c. There was also another movement which may be termed partial migration, *i.e.*, birds pass from one part of the country to another without crossing the sea, as some of the Wagtails, Larks, Tits, and Sparrows. It was also interesting to note the regularity with which our summer migrants arrive, contrasted with their departure or the arrival of others in autumn, which was no doubt to be accounted for by the seasonal changes being more regular in the countries from whence they come than in our changeable climate. The time of their arrival showed little variation over a number of years.—MICROSCOPICAL GENERAL MEETING, February 15th. Mr. J. E. Bagnall exhibited a number of rare plants, including *Orchis purpureus*, *Urtica pilulifera*, and *Carex frigida;* also, on behalf of Mr. Cummin, of Rugby, *Lagurus ovatus*, *Neottia æstivalis*, *Digitaria sanguinea*, and *Scirpus Savii*, from the Channel Islands; and on behalf of Rev. J. Caswell, *Iberis amara*, and *Nepeta Cataria*, from Stour, Oxfordshire. Mr. W. J. Harrison exhibited a palæolithic and a neolithic flint implement, which excited considerable attention. Mr. A. H. Atkins exhibited *Meristella tumida*, showing the spiral processes of the arms. Mr. R. W. Chase exhibited an extensive series of birds in the down, including five stages in the life of the Gannet, (*Sula bassana.*) the Dabchick, Owls, Snipe, Partridge, Quail, Cuckoo, Kingfisher, Stormy Petrel, and Nightingale, with fifteen others. Mr. W. P. Marshall then read a paper, illustrated by several excellent drawings, on the "Buttertubs," some singular waterworn excavations in limestone on the slope of Stag Fell, Yorkshire. These are pits of most irregular outline, with level floors and perfectly perpendicular walls, which have been scooped out of the limestone by the slow chemical action of the carbonic acid gas contained in the water which trickles down their sides. They are all of the same depth of 25ft., which is the thickness of the limestone stratum. An interesting discussion followed, in which Mr. Marshall's theory of their formation was finally approved.

BIRMINGHAM AND MIDLAND INSTITUTE SCIENTIFIC SOCIETY.—February 2nd, 9th, and 16th. Mr. C. J. Watson gave a course of three lectures on "Astronomy." The appearance of the stars was described, and their apparent movement explained by the rotation and orbital motion of the earth. In the second lecture the mechanical laws of the revolutions of the planets were explained; and finally, in the last lecture, the seasons, tides, harvest moon, mean solar time, and other phenomena more closely connected with the earth, dwelt upon. Mr. W. P. Marshall exhibited and explained a large chart of the Solar System, constructed with great care, and which proved of much interest to the members.

BURTON-ON-TRENT NATURAL HISTORY AND ARCHÆOLOGICAL SOCIETY.—January 18th. Mr. T. J. Wilkins, of Uttoxeter, read a very interesting paper on "Microscopic Pond Life: How to Find and How to See." Mr. Wilkins illustrated his paper by drawings, for which the society was indebted to Mrs. Wilkins.

CHELTENHAM NATURAL SCIENCE SOCIETY.—January 20th.—Rev. E. Cornford read a most interesting paper entitled "A Comparative Sketch of the Organs of Vision," illustrated by a number of diagrams and microscopic objects. Dr. Robert Smith, Dr. Ferguson, Mr. Day, and Dr. Wright, (the president,) took part in a discussion on the paper, for which a vote of thanks was unanimously given. Feb. 17th.—Mr. R. Tyrer read a paper on "Meteorology and its Practical results."

PETERBOROUGH NATURAL HISTORY, SCIENTIFIC, AND ARCHÆOLOGICAL SOCIETY.—January 24th.—Public Meeting and Lecture by Mr. B. J. Malden, on "Cannon Street to Cabul," illustrated with the triple oxy-hydrogen apparatus. February 1st.—Lecture by Mr. B. N. Shaw, Demonstrator of Physics to the University of Cambridge, on "Weather Charts and Storm Warnings," illustrated by means of charts, &c., to show the position of the Isobars by means of which the weather is foretold.



A W Mills del ad nat

ON THE DESMIDIEÆ OF NORTH WALES.

(*Continued from page 43.*)

To the list of Desmidieæ found in North Wales, which was published in the February number of this journal, must now be added the two rare species, *Cosmarium globosum*, Buln.; and *Staurastrum Saxonicum*, Reinsch.

At the time when that list was prepared, there was some doubt as to the identity of my specimens with the former plant, inasmuch as they do not correspond in certain particulars to the description published in "Rab. Fl. Eur. Alg.," nor yet to the figure given by Nordstedt in his "Desmidieæ Arctoeæ, 1875."

The kindness of Dr. M. C. Cooke has now enabled me to compare them with the original specimens of Bulnheim, published in "Rabenhorst's Alg. Exsic.," and I conclude that the species is subject to considerable variation, and that there is nothing in the form taken by myself in Wales to entitle it to rank as a distinct species.

Staurastrum Saxonicum has been twice figured by Reinsch, and between his two drawings there are material differences. My plant combines the characters of the two, and as I cannot identify it with any other known species, I conclude that it must really be referred to this rare form.

As neither of these plants has been hitherto detected in the British Isles, they must be added to our list as—

***Cosmarium globosum*, Buln.

***Staurastrum Saxonicum*, Reinsch.

There remain to be noticed three entirely new species, and as Dr. Cooke has already dealt with these in the last number of "Grevillea," I borrow, with his permission, the descriptions which he has given, adding figures drawn from my own specimens.

Cosmarium Cambricum, nov. sp., (Plate V., Fig. 1.)

Frond longer than broad; constriction, linear; segments, quadrilateral, narrowed from the base upward; sides, with two sinuations, and one in the centre of the end, the latter rather the broadest; side view, segments oval, narrow, rounded at the ends, with a shallow constriction; end view, elliptical.

REFERENCES TO PLATE V.

Fig. 1.—*Cosmarium Cambricum.*—Nov. sp.
,, 2.— ,, *coronatum.*—Ditto.
,, 3.—*Staurastrum anatinum.*—Ditto.
,, 4.—*Micrasterias Americana,* forma major.—Reinsch.
,, 5.—*Cosmarium cyclicum.*—Lund.
,, 6.— ,, *pseudonitidulum.*—Nordst.
,, 7.—*Staurastrum megacanthum.*—Lund.
,, 8.— ,, *Cerastes.*—Lund.
,, 9.— ,, *Arctiscon.*—Ehr.
,, 10.— ,, *pseudofurcigerum.*—Reinsch

Length, ·016—·018 mm.; breadth at the base, ·036—·038 mm.; at the end, ·02—·022 mm.

Allied to *C. tetragonum* and *C. Nymannianum*, from both of which it differs in the character of the sides and ends and the number of sinuations.

It has been found in two or three stations in North Wales, but not elsewhere. The empty frond seems to be minutely punctate.

Cosmarium coronatum, nov. sp., (Plate V., Fig. 2.)

Frond about as long as broad, or rather shorter; constriction, deep, linear; segments, quadrilateral, narrowest at the base, and dilated upwards, very slightly convex at ends, rough all over, with elongated conical granules, arranged in lines, (about eight at the end and four on each side;) side view, truncate at the ends; end view, elliptical.

Length, ·065—·07 mm.; breadth, ·075—·08 mm.; isthmus, ·02 mm.; side view, ·045 mm. broad.

This resembles *Cos. biretum* in form, but the granules are conical and prominent, as in *Cos. Brébissonii.* The almost truncate ends, in front view, have eight of these conical projections, which impart a coronetted appearance.

In side view the ends are also truncate, which would be sufficient to distinguish it from closely allied species, and the regular elliptic ends separate it distinctly from *Cos. biretum.* By many features this seems entitled to rank as a distinct species.

Staurastrum anatinum, nov. sp., (Plate V., Fig 3.)

Segments in front view, broadly fusiform; rough with prominent granules, which are truncate on the outer margin; processes elongate, rough, terminated with minute spines. End view tri-radiate, processes elongate, rough, slightly and gradually concave, nodules at the centre truncate.

Length, ·05 mm.; breadth, including the processes, ·1 mm.; breadth at the sinus, ·02mm.; length of the processes, ·025mm.

Allied to *S. Sebaldi*, but differs in the front view in the broadly fusiform segments, and the upward rather than downward direction of the processes; hence the third process is usually visible on one or both segments in the front view.

Hence, if we denote new species by three asterisks, we may further add to our list—

******Cosmarium Cambricum.***

******Cosmarium coronatum.***

******Staurastrum anatinum.***

Dr. Cooke has figured the following new or rare forms found by myself at Capel Curig, in 1880, in recent numbers of "Grevillea," viz., *Staurastrum anatinum*, *S. aversum*, *S. Brasiliense*, *S. grande*, *S. longispinum*, *S. ophiura*, *Cosmarium pseudoconnatum*, *Docidium nodosum*, and the forms of *Tetrachastrum* representing *T. oscitans*, *T. mucronatum*, and intermediate ones.

I now add figures of seven rare species not hitherto figured in English works, all drawn from my own specimens, and to a uniform amplification of 400 diameters, in addition to the three new species described above.

March 15th, 1881. A. W. WILLS.

[ERRATUM.—By a printer's error, on page 43, an asterisk was prefixed to *Xanthidium armatum*, which our readers are requested to efface in their copies.—EDS. *M. N.*]

FARMING AND NATURAL HISTORY NOTES FOR THE YEAR 1880.

BY THE REV. T. A. PRESTON, M.A.

The district to which the following remarks principally apply is roughly that part of England south of a line drawn between the mouths of the Yorkshire Ouse and the Severn, though even in this limited area some counties are not represented. It may, however, be considered as descriptive of the state of the midland and southern districts during the year 1880.

As regards farm crops, it was at one time a most promising year. Seldom before had such cold and dryness served so favourably for breaking up and cleaning the land as after the terrible season of 1879. The rain of February came at the right time for the seed, and good crops both of hay and grain were looked forward to. May, however, was a very dry month, and, especially towards the end, the country was suffering from drought, and the hay crop threatened to be a failure. Still what there was would have been good, serviceable food, not like the unripened rank growth of the previous year, but the heavy rains of July frequently not only destroyed the hay so as to render it not even worth the trouble of taking off the land, but in the low-lying districts carried it bodily away. These rains also affected the corn, which till then looked very promising, and had it not been for a fine August and September, another bad harvest would have followed. Some of the damage caused by the rain was repaired, but, especially in the eastern counties, the corn was very poor. At Grantham, in Lincolnshire, "harvest commenced on the 23rd August, and the first fortnight was splendid. Then came a week of heavy rain and a hailstorm of five minutes duration, which saturated the unthatched stacks from top to bottom. Some stacks, when thrashed out, only realised from one quarter to eight or nine per acre, utterly spoiled, and others when opened were like manure heaps. Farmers cannot remember such a year, and are far worse off than they were in 1879 in this part of the country." Root crops, as a rule, appear to have done well, and this is, perhaps, the redeeming feature of the year. The second growth of grass was most luxuriant, especially in Shropshire, but there was but little mown, and no second crop was secured.

The fruit crop, with the exception of gooseberries, currants, and strawberries, has been a general failure. In many cases the wood of 1879 could not be ripened from want of sun, and the extreme severity of the winter killed not only that year's growth, but also that of the year before, in many cases. Where this was the case, there naturally was no crop of fruit, but in some localities the show of bloom was astonishingly great. Just at the time of expansion of the flower, however, cold and wet set in, and rendered the whole unproductive. Wall fruit was everywhere (as far as I can learn) a failure. The only fruits which appear to have been generally plentiful were gooseberries, currants, strawberries, and even they were not universally so. Garden seeds, both of vegetables and flowers, were not up to their proper quality from the want of sun in the previous year.

Wild flowers appear to have been scarcer than usual, not only in the number of species, but also in the number of specimens. A few marsh plants, as the Marsh Marigold (*Caltha palustris*,) and the Cuckoo Flower (*Cardamine pratensis*,) seem to have been much benefited by the damp season of 1879, and reports generally state that they were in wonderful profusion. A few other plants, as the Wild Rose (*Rosa canina*,) were in magnificent bloom for a short time, but with these few exceptions it has been a bad year, botanically speaking. Plants were, naturally, earlier than in 1879, but later than in the four previous years as regards the time of flowering. At Marlborough, comparing the dates of first flowering of about 450 plants with the mean for the previous fifteen years, plants were later till about the second week in March, then generally a little earlier till the middle of May, and after that later. It is very curious that at Plymouth no less than fifty-nine species were found in flower between the 1st and 3rd of January, but at most other places very few, if any, were found in January or February.

Monstrosities have not been common. The most noteworthy are the Colchicum and the common garden cabbage. In the former, the autumn flowers were very scarce; but in the spring, instead of the usual seed vessels and leaves appearing, there came up with the leaves, in many cases, the ordinary flowers, and in others a very curious malformation. The segments of the perianth were long and narrow, and of a dirty white, the anthers without pollen, and the ovaries merely rudimentary. In the latter, in two places in Wiltshire, the cabbage leaves assumed a funnel shape, or a portion of the midrib separated and projected above the surface of the leaf, terminating in a funnel-shaped expansion.

Among insects may be noted the unusual abundance of the Camberwell Beauty (*Vanessa Antiopa*) among butterflies, and of wasps, which were in immense numbers in most parts of England. *Aphis*, or Green Fly, was very abundant in the early part of the year, and wild flowers, notably the Mealy Guelder Rose (*Viburnum Lantana*,) were sometimes covered with it. The larvæ of the Gooseberry Moth (*Abraxas grossulariata*) and of the Gooseberry Saw-fly (*Nematus Ribesii*) were also extremely destructive, and threatened the ruin of the crops, had not artificial means been used to destroy them. The larvæ of the Crane-fly (*Tipula*) were a perfect plague in some localities, and Sheep Ticks in others. Both of these latter are undoubtedly the result of the wet season of 1879. On the other hand, butterflies, especially of the common kinds, have been generally scarce.

With regard to birds, their song, as a rule, was earlier in 1880 than in 1879, whereas the Swallow and Swift were later in the time of their arrival, and the Rook a week later in building. A scarcity of Swallows was generally noticed, and also of small birds. A few may have been killed by the cold, but by far the larger part migrated to warmer localities. With the outbreak of the cold weather, the rush of small birds to the eastern coast was astonishing, and the destruction of them (especially of Larks) by bird-catchers was so great as to call forth remonstrances in the public prints. I am assured, however, that the number killed, great as it was, proved but a very small proportion of those which arrived and escaped, and that there was not the slightest fear of any of them becoming extinct.

THE FLORA OF WARWICKSHIRE.

AN ACCOUNT OF THE FLOWERING PLANTS AND FERNS OF THE COUNTY OF WARWICK.

BY JAMES E. BAGNALL.

(Continued from page 57.)

PLAN OF THE FLORA.

The flowering plants and ferns found in this county are arranged in accordance with the "London Catalogue of British Plants," Ed. vii. The English name I have usually taken from Syme's "English Botany," Ed. iii. Following this is a statement of the opinion of Mr. Hewett C. Watson, as to the plant named being entitled to rank as a native, denizen, colonist, casual, or alien, as set forth in the "Compendium of the Cybele Britannica." In many instances I shall add my own opinions as to the position the plant holds in the Flora of Warwickshire. Following this, the nature of the habitat will be given. These particulars are followed by terms indicating the comparative frequency of the plant. These are common, rather common, locally common, local, rather rare, rare, very rare.

Following this I have given the flowering season, so far as my experience will enable me to do.

The districts will be numbered I. and II., and when localities are given each district will have a separate paragraph.

No. I. will indicate the Tame district, or that portion of the county drained by the Tame.

No. II. the Avon district, or that portion of the county drained by the Avon. With regard to the boundary lines of these districts, I hope to give full detail at the end of the Flora.

In all cases where I record a plant on the authority of a printed work, written document or otherwise than from my own note book, I shall give abbreviations or initials to indicate this fact, and where I have myself seen these plants in the habitat cited shall indicate this by the mark ! after the habitat. All stations not so initialed are inserted from my own personal observations.

List of books and authorities quoted in the Flora, with the abbreviations :—

Bak. Mon.—Monograph of British Roses, J, G. Baker, 1869.

Bab. Man.—C. C. Babington, M.A., F.R.S., Manual of British Botany, Ed. vii., 1874.

Bab. Brit. Rub.—C. C. Babington, M.A., F.R.S., The British Rubi, 1869.

Bot. Guide.—The Botanist's Guide, by Dawson Turner and L. L. Dillwyn, 1805.

Cyb. Brit. Comp.—H. C. Watson, Compendium to Cybele Britannica and Sup., 1870-72.

Gibs. Camd.—Bishop Gibson's Camden's Britannia, Ed. i., 1695.

Gough's Camd.—Richard Gough's Camden's Britannia, Ed. i., 1789.

Ick An.—Dr. Ick in Analyst, Vol. VI., 1837.

N. B. G.—New Botanist's Guide, H. C. Watson, 1835-37.

Perry.—A Select List of Plants found in Warwickshire, J. G. Perry, 1817 ; Plantæ Varvicenses Selectæ, J. G. Perry, 1820.

Purt.—Midland Flora, 3 vols., Thomas Purton, 1817-21.

Phyt.—The Phytologist, 11 vols., 1841-63.

Ray, Cat.—Catalogus Plantarum Angliæ, Joannis Raii, 1672.

Syme, E. B.— English Botany, Ed. iii., 1863-1872.

Top. Bot.—H. C. Watson, Topographical Botany, 2 vols., 1873-74.

Y. and B.—Catalogue of Plants Collected in Warwickshire, Rev. J. R. Young and Dr. R. Baker, 1873.

With.—Arrangement of British Plants, W. Withering, M.D., Ed. v., 1812.

Rev. A. B.—Rev. Andrew Bloxam, M.A., Vicar of Twycross.

H. B.—Henry Bromwich, Milverton.

Rev. J. C.—Rev. John Caswell, St. Mary's College, Oscott.

Newb.—Rev. W. W. Newbould, M.A., F.L.S., Kew, London.

J. P.—J. Power, MS. Notes in Botanist's Guide.

H. W. T.—H. W. Trott, Rugby.

Many other works than those above given have been referred to, but as I shall rarely quote them, I have not encroached on my limited space by citing their titles.

HERBARIA QUOTED IN THE FLORA.

*Herb. Bor.—The Herbarium of the late W. Borrer, at the Royal Herbarium, Kew.

*Herb. Bab.—Prof. Babington's Private Herbarium at Cambridge.

Herb. Perry.—The Herbarium of the late J. G. Perry, at the Museum, Warwick.

PHANEROGAMIA.

DICOTYLEDONES.

RANUNCULACEÆ.

CLEMATIS.

C. Vitalba, *Linn.* *Traveller's Joy.*

Native: In hedges and thickets in calcareous soils. Locally common. August to September.

I. Near Curdworth Bridge. Probably planted.

II. Hedges on high ground between Norbrook and Norton Lindsay. *Perry Fl.*, p. 46. Leek Wootton, Whitnash. *Y. and B.* Chesterton! Oakley! *H. B.* Allesley, rare. *Rev. W. T. Bree*, *N.B.G.*, 1830. Sand quarry, lane from Allesley to Brownshill Green Probably introduced. Oversley Wood, Drayton Bushes, Grafton, Binton.

THALICTRUM.

T. flavum, *Linn.* *Yellow Meadow Rue.*

a. sphærocarpum the only variety observed at present.

Native: Wet meadows, river banks and ditches. Rather rare. June, July.

I. Abundant by the River Tame, near Aston Church, 1879; near Blythe Hall, Hams Hall Grounds, Forge Mills, Minworth.

II. Banks of the Avon, at Bidford! the Arrow, near Beauchamp Court. *Purt.*, i., 267. Banks of the Leam, between Leamington and Radford. *Perry Fl.*, p. 46. Offchurch. *Y. and B.* Beside the Avon, Brown's Over Fields. *R.S.R.*, 1877. River Leam, at Offchurch, 1873. *H. Bromwich, Herb. Bab.*

ANEMONE.

A. nemorosa, *Linn.* *Wood Anemone, Wind-flower.*

Native: Wet fields, woods, banks, &c. Rather common. March to May.

Found throughout the county.

In many of the Lias districts a form is abundant having pink sepals.

MYOSURUS.

M. minimus, *Linn.* *Common or Little Mousetail.*

Native: Sandy cornfields, &c. Rather rare. May, June.

I. Chelmsley Wood. Bot. Guide, 1805. I have never been able to find this plant here, although I have searched for it several seasons. Cottage garden, Atherstone, *J.P.* Atherstone outwoods, Coleshill. *Rev. W. T. Bree, Mag. Nat. His.*, iii., p. 164.

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* All my notes from these sources are due to the kindness of the Rev. W. W. Newbould, M.A.

II. In a field near the cross between Norton Lindsay and Warwick, *Perry Fl.* 28. Alne Hills, and at Studley in a field, *Purt* i., 167. Milverton, Myton! *H. B.* Whitnash! *Y. and B.* By the River Avon at Brown's Over, *H. W. T.*

RANUNCULUS.

R. circinatus, *Sibth.* *Rigid-leaved Water Crowfoot.*

Native: Rivers, streams and pools, &c. Locally abundant. July to August.

I. Streams and pools, Sutton Park; River Blythe, near Stonebridge; brook, near Hampton-in-Arden.

II. Radford Canal, Chesterton, *Y. and B.* Harboro' Magna, *Rev. A. B.* Old canal, near Rugby! *H.W.T.* River Arrow, near Oversley Bridge; canal, near Stratford-on-Avon; River Sow, near Wyken Church, *T. Kirk, Herb. Bor.* I find this growing in company with *R. fluitans*, and yet retaining its characteristic differences.

R. fluitans, *Linn.* *River Water Crowfoot.*

Native: In rivers and streams. Locally abundant. July to August.

I. In the River Tame and brooks that run near it, *Ray Cat.*, 1672. In the Tame, near Aston Church; in the Cole, near Bacon's End; in the Blythe, at Hampton-in-Arden, Little Packington, Coleshill, stream at Minworth.

II. In the Avon at the weir-bridge, Stratford-upon-Avon, *Perry Fl.*, p. 47. In the Avon, near Stoneleigh, *H. B.* River Alne, Aston Cantlow.

Two very distinct forms occur, one having large flowers with contiguous petals, the other with smaller flowers and petals not contiguous.

R. peltatus, *Fries.* *Common Water Crowfoot.*

Native: Rivers, streams, and pools. Locally abundant. May to September.

Var. *a. truncatus.*

I. Sutton Park, abundantly. Small pool at Marston Green. Stream in lane from Solihull to Shirley. Stream near New Park, Middleton.

II. Harboro' Magna, *Rev. A. B.* Chesterton, *Y. and B.* Beausale Common, *H. B.* Yarningale Common.

R. peltatus, Stoke Heath and Wyken Green. *T. Kirk*, 1856, *Herb. Bab.* Honily, *H. B.*

Var. *b. floribundus*, Bab.

In streams, ditches, and pools throughout the county. Common.

Var. *c. penicillatus*, Hiern; *pseudo-fluitans*, Newbould.

Streams and canals. Rare.

I. In the Blythe, at Blythe Bridge, Solihull. Abundant.

II. Brook at Radford Semele; Fishers Brook, near Warwick, *H. B.* A variety with long rigid capillary segments allied to this occurs in the canal at Sow Waste, also in the canal near Stratford-on-Avon. *R. floribundus* occurs with and without floating leaves constantly in our streams.

R. diversifolius, *Gilib.*

Native: Pools, ditches, and streams. Local. May to September.

Var. *a. radians*, Hiern.

I. Sutton Park, Wheyporridge Lane, near Solihull, with small flowers; Ansley, in a small pool near the turn for Bentley Park; cattle pool, Berkswell Park; Elmdon.

II. Near Coombe Abbey; canal near Harboro' Magna, *Rev. A. B.*; Pool between Hawkes End and Allesley, confirmed for me by Mr. Hiern. *R. heterophyllus*, Myton, *Y. and B.*; Sow Waste Canal, near Coventry, *T. Kirk*, 1857, *Herb. Bab.*

Var. *b. Godronii*, *Gren.*

I. In shallow pools, very rare. Marston Green, near Elmdon; Ansley, near Bentley Park.

II. Grove Park, Woodloes, *H.B.*; Yarningale Common. The plant from Yarningale Mr. Hiern considers midway between *Godronii* and *radians*.

R. triphyllos, *Wallr.*

Native: In pools. Rare. May to August.

I. Small pool at Ansley. Pool near Hampton-in-Arden.

II. Near Leamington; *C. Bailey* in Exch. Club Report, 1879, p. 4.

R. Drouetii, *Schultz.*

Native: In ditches and pools. Local. May to July.

I. Small pool at Elmdon; near Packwood Windmill; Stream near Knowle Station; Sutton Park; Marston Green.

II. Near Coombe Abbey; with nearly double flowers in a stream at Allesley; Kineton; pools near Drayton Bushes and near Billesley; in a field beyond Church Over, *L. Cummin*; Myton, *H. B.*; Beausale, Chesterton, *Y. and B.*; pond near Brandon, *T. Kirk*, *Herb. Bor.*

R. trichophyllus, *Chaix.* *Hairy Water Crowfoot.*

Native: In pools. Rather rare. May to July.

II. Kenilworth, *Y. and B.*; Harboro' Magna, *Rev. A. B.*; near Coombe Abbey; pool at Drayton Bushes; Yarningale Common. The plant from Drayton Bushes may be *R. submersus*.

R. Lenormandi, *F. Schultz.* *Lenormand's Water Crowfoot.*

Native: Streams and near pools. Local. April to August.

I. Very abundant in Sutton Park; ditches near Middleton; Balsall Street, near Berkswell, *Y. and B.*; small pool near the Blue Boar, Dunchurch, *L. Cummin.*

R. hederaceus, *Linn.* *Ivy-leaved Water Crowfoot.*

Native: In shallow pools or on the mud of streams. Common. March to August.

I. Sutton Park; Hampton-in-Arden; Marston Green; Barston, *Y. and B.*; Solihull; small stream near Hill Bickenhill.*

II. Coventry, *Y. and B.*; roadside between Hatton and Rowington, *Perry*, 1820; Brandon, *H. B.*

(To be continued.)

CORRECTION.—At page 54 Mr. Joseph Power is incorrectly called "Professor." He was Librarian of Cambridge University and Fellow of Clare College.—J. E. B.

ENTOMOLOGICAL RAMBLES IN THE MIDLANDS.

IV.—SUTTON PARK IN WINTER.

BY W. G. BLATCH.

"I suppose insects are killed by the cold weather, and that it will be of no use to search for Bugs and Beetles in winter; that, in fact, I must bottle up my new-born entomological ardour until the warm days of spring make collecting possible?" Such was the enquiry

* Floating; having rounded shallow leaf lobes, petals small, five veined; very near *R. homœophyllus*, Hiern.

recently addressed to me in a letter from one of my correspondents who is desirous of becoming an Entomologist. As soon as I read it I thought what a capital suggestion it contained of a subject to be worked out in our next "Ramble." The winter is here. Suppose we make a January excursion, with the view of showing what Entomological work can be accomplished during the winter season, and of exploding the popular fallacy that insects can only be found in summer time. Some who join us will, no doubt, be surprised at the result of our exploration, for even young Entomologists often fall into the error that hexapods are killed by severe cold, and that during winter the most ardent follower of Kirby and Spence must be content with such Entomological work as can be done indoors, *i.e.*, naming and arranging previous captures, and preparing his *instrumenta belli* for the coming summer's campaign. The fact is, there is no day in the year when insects cannot be found by anyone who knows where to look for them, and who is willing to sacrifice his personal comfort to his Entomological enthusiasm. Myriads of insects, of all orders, pass the winter in the perfect or winged state, hid away securely in their various *hybernacula*, sublimely indifferent to the raging storm and uninjured by the most intense frost. In truth, paradoxical as it may appear, the more severe and prolonged the winter, the better their chances of survival. To me this does not seem difficult to account for. In mild winters *ova* hatch whilst the trees are still bare, and the young *larvæ* perish for want of food; hybernating *larvæ* are tempted from their safe retreats and become a prey to watchful birds; winged insects fly abroad in the transitory and treacherous sunshine and are eagerly caught and destroyed by various larger animals that are ever on the watch seeking what stray flies and beetles they can devour. Thus, not only do they perish, but their prospective progeny is cut off with them. Anyone can readily confirm this view by becoming, even in a small way, an observer of insects during one or two seasons. The time and labour thus bestowed would not be ill-spent. On the contrary, the observer would obtain a mass of special knowledge which would greatly astonish him and prove a source of endless wonder and delight to himself and his friends.

But, to pursue our subject, let us at once start on our winter expedition in search of insects. And suppose we make Sutton Park—a spot well-known and beloved by all of us—the scene of our ramble. There we shall find nearly all the conditions favourable to our enterprise, as well as many of the kinds of insects obtainable at this season. Arrived at the park, we make our way, in the first place, to Blackroot Pool, at the north end of which is a bog, (certainly in "reduced circumstances" since the railway encroached upon it, but still a bog,) in which *Typha* and *Iris* and *Sphagnum* delight to dwell, and where the lady fern flourishes in such perfection as to prove the truth of the saying that—

> "Where the morning dew lies longest,
> There the lady fern grows strongest."

In summer, this spot possesses features of considerable beauty, and abounds with living things. Now the wintry blasts have denuded the trees, the reeds have been killed by biting frosts, and all is silent and still, as if life had entirely deserted the place. No animated beings but ourselves can be seen, not a bird flits from tree to tree, not a fish can leap through the ice-bound pool, not even a midge survives to dance fitfully in the chill air, and the less persevering Entomologists might not unreasonably retire, saying they could see and find nothing. At this stage it may not be amiss to "point the moral and adorn the tale" by inculcating the importance of "patience and perseverance," of a disposition to look beneath the surface of things, and not be content with a merely superficial examination. Herein lies the secret of success in this as in other pursuits. By means of the knowledge acquired by close and accurate observation, one Entomologist will find a store of insect treasures in a locality which a collector less informed might visit a hundred times, without obtaining a single species of any interest. But, bottling up our philosophy for a future occasion, let us now to work. Shod with waterproof "Napoleons," and armed with a strong jack-knife, we enter the bog with confidence as to our apparently hopeless task. Standing in the inky, oozy quagmire, and spreading a sheet of strong brown paper on one of the driest grass clumps at our side, securing it by stones to prevent its being blown away by the wind, we cut off one of the dead reeds close down to the water, hold it over the paper, and strip it carefully, fold by fold, the process being repeated *ad libitum.* Insects of many kinds tumble out, the rude shaking they receive being evidently a great surprise to those species that are not sufficiently dormant to be in a state of blissful ignorance of what is going on. Saw-flies and Ichneumons wake up from their torpor, and scramble helplessly about, twisting round and round in the most comical manner. Centipedes drop upon the paper like cats, with all their wits and all their legs in full operation. Spiders of several sorts issue from their warm silken *hybernacula*, and seem to resent our intrusion upon their snug privacy. Prominent among these is *Clubiona holosericea*, a large, pale, silky species, very beautiful, and likewise very ruthless, as indicated by the large quantity of insect remains in the vicinity of its nidus. Amongst the other occupants of the reeds are some lepidopterous larvæ and pupæ, a few dipterous flies, and several bugs, the most abundant species being *Salda cincta.* The *Collembola* (Spring-tails) are fairly represented, and even the delicate *Aphis* has survived the biting frosts, and found a refuge here. Coleopterous insects (beetles) are most numerous, and comprise representatives of nearly all sections of the order. Conspicuous amongst them is the fine and comparatively rare *Anchomenus puellus*, a species unknown to this district until I had the pleasure of adding it to our lists last year. It is an elegantly-formed beetle, pitchy-black, with brownish legs, and has a more slender thorax than any of its allies, which, from its fancied resemblance to a girl's waist, has, I suppose, led to its being named *puellus.* Generally scarce, this beetle occurs in some plenty here, living gregariously in winter only. in the folds of the dead reeds. All my efforts to find this species during the summer months have resulted in failure, and Dr. Sharp, who takes it near Edinburgh, tells me that his experience in this respect corresponds with mine. His opinion is that as soon as the mild weather sets in it flies away to the more inaccessible parts of the bogs and marshes. This is not the only species that cannot be found in summer time—a fact which alone shows the importance of winter collecting.

Three other species of the genus *Anchomenus*, all of which we are glad to find, accompany *puellus*, viz.—*A. micans*, *A. piceus*, and *A. gracilis*—the latter an intensely black species of small size and elegant outline. Now and again we turn out a specimen of the very common *A. fuliginosus*, but never actually in company with *A. puellus*—the latter possibly considering itself too aristocratic to associate with such a plebeian as the former, which, by-the-bye, we can obtain in abundance from the *Sphagnum* growing at our feet, a habitat not frequented (so far as my experience shows) by *puellus*.

The genera *Demetrias*, *Dromius*, *Badister*, *Pterostichus*, *Amara*, *Bradycellus*, and *Bembidium* are well represented—*Pterostichus* more numerously than the others, the species being *vernalis*, *nigrita*, *gracilis*, *minor*, *strenuus*, and *diligens*. *Noterus sparsus* and a few *Hydropori* also occur, as well as *Laccobius minutus*, and several species of *Helophorus* and *Cercyon*. The important section *Brachelytra*, as might be expected, stands out very prominently amongst the others—*Homalota*, *Gyrophæna*, *Conurus*, *Tachyporus*, *Quedius*, *Philonthus*, *Xantholinus*, *Lathrobium*, *Lesteva*, *Homalium*, and *Stenus* being the genera to which the majority belong. Of the species of *Stenus* found here quite a long list could be given, some of them being rather uncommon. Now and again we turn out a specimen of the pretty *Baptolinus alternans*, as also of the curious and unique *Cryptobium fracticorne*. One or two species of *Evæsthetus* occur in some plenty, and occasionally we are rewarded for our perseverance by the acquisition of *Hygronoma dimidiata*—a small, narrow, elongate "Staph," blackish, with the apical two-thirds of its elytra pale straw-colour. The rare *Ocyusa picina* also occurs here in company with its less scarce congener, *O. maura*. The *Clavicornia* are largely represented by the genera *Telmatophilus*, *Cryptophagus*, *Atomaria*, *Lathridius*, and *Corticaria*. One of the prettiest beetles, belonging to this group, which we have had the pleasure of capturing here (only very sparingly though) is *Psammœchus bipunctatus*—a tiny yellow beetle with two black spots on the elytra. Our researches reveal the interesting fact that several weevils *(Rhynchophora)* are in the habit of taking up their winter quarters in these dead reeds; for amongst our captures are several species of *Sitones*, *Erirhinus nereis*, *&c.*, *Mecinus pyraster*, *Orchestes quercus*, *&c.*, *Cœliodes*, *Baris T. album*, and a considerable number of Apions. The *Longicornia* are totally absent; but there are plenty of *Phytophaga*, including *Donacia linearis*, *sericea*, and *comari*, *Lema cyanella*, *Chrysomela polita*, *Phædon cochleariæ*, *Prasocuris phellandrii*, *Galeruca calmariensis*, *Aphthona*, *Phyllotreta*, *Thyamis*, *Cassida oblonga*, and *obsoleta*, *Sphæroderma*, *Coccinella 19-punctata*, *bipunctata*, *7-punctata*, and *22-punctata*, *Scymnus frontalis*, *Rhizobius litura*, and *Coccidula rufa*.

It must not be supposed that it is always easy and pleasant to strip reeds in the way described. Often they are filled with a mass of ice, in which the insects lie entombed—not dead, but dormant—awaiting the coming of a more genial season. If taken out and placed in a higher temperature they recover from their frozen torpor and walk about as if nothing had happened. In very cold weather standing in a bog picking insects from the icy flags is anything but conducive to the comfort of one's extremities, and one is soon glad to vary the occupation. Fortunately, we can change both our ground and our method, without loss of either interest or occupation, and greatly to the advantage of our half-frozen fingers and toes. A short walk at once promotes our circulation, and brings us to a number of oak trees, at the roots of which we can vigorously ply our diggers with the certainty of finding lots of pupæ of moths. In company with these are many other kinds of insects—Ichneumon-flies, Humble-bees, Saw-flies, and Beetles. Amongst the latter we soon recognise several old friends, including two or three species of *Notiophilus*, *Carabus catenulatus* and *violaceus*, the ubiquitous *Nebria brevicollis*, *Leistus spinibarbis*, *fulvibarbis*, *ferrugineus* and *rufescens*, *Loricera pilicornis*, *Badister bipustulatus*, *Anchomenus junceus* and *prasinus*, *Pterostichus niger*, *vulgaris*, and *striola*, two or three *Bembidia*, a large number of "Staphs"—including the formidable-looking *Ocypus olens*, the pretty *Xantholinus glabratus*, and several *Philonthi*—and the shiny but sluggish *Silpha atrata*.

Being tired of stooping, let us now stand up and search the bark of these same trees, in which we may find more insects and of a different stamp. Here are several species of *Coccinella*; *Dromius meridionalis*, *agilis*, *quadrimaculatus*, and *quadrinotatus*; two or three *Anchomeni*; the rare *Scydmænus exilis*; *Soronia grisea*; *Rhizophagus ferrugineus*, and *bipustulatus* (in dead trees;) *Helops striatus*; *Salpingus castaneus*; *Rhinosimus ruficollis*, *viridipennis*, and *planirostris*; and *Orchestes quercus*. The hinder femora (thighs) of the last-named beetle are very powerful, and enable it to jump a most surprising distance. I have often envied this beetle and wished that I had a similar power, in proportion to my larger bulk, so that, when a long distance from home, tired and hungry—no inn or railway near at hand—I could just take a few leaps and be there! In removing the bark from a dead oak tree we turn out a large number of the fat white larvæ, and, now and then, a pupa, or an imago, of *Rhagium inquisitor*, a beetle of the long-horn section, which may be obtained freely from this time until May, scarcely a dead oak at Sutton being untenanted by this insect in its several stages of development.

Having had enough of bark-stripping, we next collect some of the dead leaves lying around, shake them over paper, and put the residue —"extract" as it is called—into bags, to be taken home and searched at our convenience. From this we shall obtain plenty of good things—*Geodephaga*, *Brachelytra*, *Clavicornia*, &c.

Then we turn to the moss growing on the tree trunks, which we also shake over paper, pulling it thoroughly to pieces, and bagging the "extract" as before. In this we find great numbers of microscopical beetles, such as *Bryaxis fossulata* and *juncorum*, *Pselaphus Heisii*, *Tychus niger*, *Eumicrus tarsatus*, *Scydmænus scutellaris* and *collaris*, and probably *Cephennium thoracicum;* besides hosts of other things. These will require much care and patience to set and name, but when properly mounted and examined, by means of our microscopes, their exquisite beauty will prove ample compensation for all our pains.

Really, winter work out of doors seems inexhaustible. By examining *Fungi* on old trees and palings we discover new treasures. Several interesting species are obtained from rotten wood, whilst from a decaying birch stump we take several larvæ of Skip-jacks *(Sternoxi)* and of the Cardinal Beetle *(Pyrochroa serraticornis)* all of which we carry home, in fragments of the wood, to be reared. But, perhaps, one of the favourite resorts of insects in winter has yet to be examined, viz., a haystack. Yonder is one that looks promising, having evidently been a rick at least two seasons. Here we can lie down on the dry hay, sheltered from the cold wind, and, spreading our sheet of paper, work in comparative comfort. Taking a handful of rubbish from the very bottom of the stack we shake it over the paper, when, lo! insects in hundreds set up a scramble for dear life. Some species are extremely active, and escape over the side before they can be secured; others content themselves with a leisurely march over the paper as if 'twere beneath their dignity to hurry, even under such extraordinary circumstances; whilst not a few manifest a remarkable degree of self-possession by remaining perfectly still for several minutes, only venturing to move off when they think all danger has passed. This habit is a very "saving" one for those that possess it, few insect-hunters having sufficient patience to wait until these insects resume the use of their legs. (and it is almost impossible to see them until they do,) the whole lot, as a rule, being pitched away after a merely cursory examination. *Steni*, *Leptacini*, *Philonthi*, *Homalia*, *Micropepli*, *Megarthri* are here in abundance; *Tylhpha fumata*, several species of *Cryptophagi*, *Atomariæ*, *Corticariæ*, *Lathridii*, and *Trichopteryx* are extremely plentiful, and along with them we find two species of *Anthicus*,—*floralis* and *antherinus*, the first named being the commonest. Nearly all sections of the order *Coleoptera* are, however, well represented, from the smallest of the *Claricoraga* (such as *Trichopteryx atomaria*) to the largest of the *Geodephaga* (e.g., *Carabus nemoralis*.) Under refuse and moss, in a boggy part of the Park, I have found the uncommon *Scydmænus hirticollis*, a beetle worth searching for.

A great deal more might be done before we return home, and even then our winter Entomologising would not be exhausted; but perhaps we have done enough for one day—sufficient, at least, to indicate what may be accomplished, and to prove that no Entomologist need stand idle at this season for want of out-door occupation.

THE MINERALS OF THE MIDLANDS.

BY C. J. WOODWARD, B.SC.

I propose calling the attention of readers of "The Midland Naturalist" to the mineral localities of the district in which this journal mainly circulates. As regards those places with which I am acquainted, I shall in some detail describe the minerals to be met with, but the greater number of localities will be derived from observations of others. In a task such as I propose, one's first duty is to ascertain what has already been done in the same direction, and here, so far as I know, only one work giving mineral localities in the Midland Counties has been published. The work in question is entitled "The Mineralogist's Directory, or a Guide to the Principal Mineral Localities in the United Kingdom of Great Britain and Ireland," by Townshend M. Hall, F.G.S., to be obtained from the author, Pilton, Barnstaple, price five shillings.

Mr. Hall has very kindly given me permission to make use of his work, so as a preliminary I have compiled the following tables from the information given in the body of the book. The use of the tables will be best seen by an example. Suppose it required to know what minerals have been met with at Matlock—look in the Derbyshire table for Matlock, and then where the letter H occurs look to the top of the table for the mineral to which it refers, it will be seen then that at Matlock the following minerals have been met with:—Aragonite, Barytes, Bitumen, Blende, Calamine, Calcite, Cerussite, Chessylite, Fluor, Gypsum, and Smithsonite.

For the purpose I have in view I shall consider the following counties as forming *The Midlands*:—Derbyshire, Gloucestershire, Leicestershire, Northamptonshire, Oxfordshire, Shropshire, Staffordshire, Warwickshire, and Worcestershire.

I take this opportunity of asking the co-operation of the readers of "The Midland Naturalist" in forming a complete and satisfactory index to the Minerals of the Midlands. Any information concerning minerals to be met with in the district will be gladly received and acknowledged.

Birmingham and Midland Institute,
Birmingham, *March 15th, 1881.*

MINERALS OF DERBYSHIRE.

Reference No.	Locality.	Alabaster.	Anglesite.	Anhydrite.	Aragonite.	Asphaltum.	Aurichalcite.	Barytes.	Bitumen.	Blende.	Calamine.	Calcite.	Celestine.	Cerussite.	Chessylite.	Cromfordite.	Dolomite.	Elaterite.	Fluor.	Galena.	Gypsum.	Hæmatite.	Malachite.	Marcasite.	Matlockite.	Melanterite.	Mispickel.	Petroleum.	Pyrites.	Pyromorphite.	Rock Crystal.	Rottenstone.	Satin Spar.	Selenite.	Smithsonite.	Sulphur.	Towanite.	Tripoli.	Vivianite.	Wad.	Yellow Ochre.	Reference No.
1	Alfreton (Crich)		H					H						H					H	H																						1
2	" (Swanwick)																					H							H													2
3	Bakewell							H				H																				H						H				3
4	" (Ashford)																															H										4
5	" (Hubberdale Mine)...													H																												5
6	Buxton							H																																		6
7	" (Redland)							H					H																													7
8	Castleton								H	H	H								H	H				H		H					H				H	H					H	8
9	(Blue John Mine)					H																																				9
10	(Odin Mine)							H	H			H						H	H							H		H											H			10
11	(Tray Cliff)					H													H																							11
12	Chesterfield (Ashover)											H							H	H																	H					12
13	Derby																H					H																				13
14	(Ashton-on-Trent)			H																	H																					14
15	(Chellaston Hill)	H																			H												H	H								15
16	Eyam		H					H			H	H								H							H															16
17	Masson Hill										H									H											H			H								17
18	Matlock				H			H	H	H	H	H		H	H				H		H														H							18
19	(Bonsall)											H																		H										H		19
20	(Cromford)		H											H		H			H	H					H											H						20
21	(Rutland Mine)						H				H																								H							21
22	Wensley											H			H																											22
23	Winster (Plackett Mine) ...													H						H																						23
24	Wirksworth							H		H	H	H		H						H										H						H						24
25	(Ballidon)																													H												25
26	(Bole Hill)																			H																H						26
27	(Brassington)		H					H						H						H										H												27
28	(Middleton)		H					H				H			H						H		H																	H		28
29	(Rent Tor)		H											H																												39
30	Youlgreave (Elton)													H																												30
31	(Newhaven)							H																																		31

MINERALS OF GLOUCESTERSHIRE.

Locality.	Agate.	Amethyst.	Asphaltum.	Barytes.	Celestine.	Calcite.	Chalybite.	Dolomite.	Fluor.	Galena.	Green Earth.	Göthite.	Hæmatite.	Jasper.	Petroleum.	Prehnite.	Pyrites.	Rock Crystal.	Selenite.	Umber.
Berkeley	H	...	...	...	H	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
„ (Woodford Bridge)	...	...	...	...	...	H	...	...	...	...	H	...	...	...	...	H	...	...	...	...
Chipping Campden (Mickleton)	H	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Clifton	...	H	...	...	H	H	...	...	H	...	...	H	...	...	...	...	...	H	...	...
„ (Durdham Down)	...	...	...	H	...	...	...	...	...	H	...	...	H	...	...	...	...	H	...	...
„ (Hot Wells)	...	...	H	...	...	...	...	...	...	...	...	...	...	...	H	...	...	...	...	...
„ (Pyle Hill)	...	...	...	...	H	...	...	...	H	...	...	...	...	H	...	...	...	...	...	...
Forest of Dean	...	...	...	...	...	...	H	H	...	...	...	...	H	...	...	...	...	...	...	H
Thornbury (Aust)	...	...	...	...	H	...	...	...	...	...	...	...	...	...	...	...	H	...	H	...
Tortworth (Dressing Green)	...	...	...	...	...	...	...	...	...	...	...	...	...	H	...	...	...	...	...	...

MINERALS OF LEICESTERSHIRE.

Locality.	Bitumen.	Blende.	Calcite.	Towanite.
Ashby de la Zouch (Staunton Harold)	H	H	H	H
„ (Lord Ferrers' Mines)	...	H	...	H

MINERALS OF NORTHAMPTONSHIRE.

Locality.	Allophane.	Yellow Ochre.
Northampton	H	...
Wellingborough (Thingdon)	...	H

MINERALS OF SHROPSHIRE.

Locality.	Barytes.	Bitumen.	Blende.	Calamine.	Calcite.	Celestine.	Cerussite.	Chalcedony.	Cuprite.	Diallagite.	Felspar.	Calena.	Hæmatite.	Kaolin.	Malachite.	Minium.	Petroleum.	Pyrites.	Reduthite.	Rock Crystal.	Serpentine.	Witherite.
Breidden Hill	H	...	...	...	...	...	...	...	...	...	H	...	...	...	...	...	...	...	...	...	H	...
Church Stretton (Penally Mines)	...	...	...	...	H	...	...	...	...	...	...	H	...	...	...	...	H	...	...	...	...	...
„ (Ratlinghope)	...	...	...	...	...	...	...	...	...	...	...	...	...	...	H	...	...	...	H	...	...	...
„ (Shelve Mine)	...	...	...	...	...	...	H	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
„ (Snail Beach)	H	...	H	...	H	...	H	...	...	...	...	H	...	...	...	H	...	H	...	H	...	H
„ (Stiper Stones)	...	...	...	...	H	...	...	...	...	...	...	H	...	...	...	...	...	...	...	...	...	...
„ (White Grit Mine)	...	...	...	...	...	...	...	H	...	...	...	H	...	...	...	...	...	...	...	...	...	...
Lincoln Hill	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	H	...	...	...	...	...
Market Drayton (Adderly)	...	...	...	...	...	H	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Much Wenlock (Benthall Edge)	...	...	...	...	H	...	...	...	...	...	...	...	...	...	...	...	...	H	...	...	...	...
Oswestry (near)	...	...	...	...	...	...	...	...	...	H	...	...	...	...	...	...	...	...	...	...	...	...
„ (Felton West)	...	...	...	...	...	...	...	...	...	...	...	...	...	...	H	...	...	...	...	...	...	...
„ (Llanymynech Hill)	...	...	H	H	H	...	...	...	H	...	...	...	...	...	H	...	...	...	...	...	...	...
Shrewsbury (Haughmond Hill)	...	H	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
„ (Pitchford)	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	H	...	...	...	...	...
Wellington (Coalbrook Dale)	...	...	...	...	...	...	...	...	...	...	...	...	H	H	...	...	H	...	...	...	...	...
Ketley	...	...	...	...	...	...	...	...	...	...	...	...	H	...	...	...	...	...	...	...	...	...
Madeley	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	H	...	...	...	...	...

MINERALS OF OXFORDSHIRE.

Locality.	Calcite.	Gypsum.	Pyrites.	Selenite.	Yellow Ochre.
Banbury			H		
Oxford (Shotover Hill)	H	H		H	H

MINERALS OF WARWICKSHIRE.

Locality.	Diallagite.	Manganite.	Pyrolusite.	Varvicite.
Atherstone (Hartshill)	H	H	H	H

MINERALS OF STAFFORDSHIRE.

Locality.	Alabaster.	Barytes.	Blende.	Calcite.	Cuprite.	Fluor.	Galena.	Hæmatite.	Mesolite.	Prehnite.	Rock Salt.	Sal-Ammoniac	Towanite.
Burton-on-Trent (Tutbury)	H												
Cheadle (Bradley)												H	
Fauld	H												
Leek (Ecton Mine)		H	H	H	H	H	H						H
(Mixton)			H										H
Pouk Hill		H							H	H			
Shirleywick											H		
Wednesbury								H					H

MINERALS OF WORCESTERSHIRE.

Locality.	Amphibole.	Aragonite.	Barytes.	Calcite.	Chlorite.	Dolomite.	Epidote.	Felspar.	Graphite.	Gypsum.	Hornblende.	Mica.	Pyrites.	Quartz.	Rock Salt.	Talc.
Droitwich										H					H	H
Dudley				H												
Malvern Hills	H	H	H	H	H	H	H	H	H		H	H	H	H		
Tewkesbury (Bredon Hill)						H										

METEOROLOGY OF THE MIDLANDS.

THE WEATHER OF FEBRUARY, 1881.

BY CLEMENT L. WRAGGE, F.R.G.S., F.M.S., ETC.

The "spirts" of high temperature and great barometric depressions of the first fortnight, with the accompanying cyclonic gales, heavy rains and snows; and the quiet weather, with high pressures, of the second part of the month, ending with a thermometric fall, are at once striking features.

STATION.	OBSERVER.	RAINFALL. Total for M. In.	Greatest fall in 24 hours. In.	Greatest fall in 24 hours. Date.	No. of rainy d.	TEMPERATURE. Greatest ht. Deg	Greatest ht. Date.	Greatest cold Deg.	Greatest cold Date.
GLOUCESTERSHIRE.									
Stroud	S. J Coley, Esq.	4·17	·80	15	14	52·0	4	20·0	22
Cheltenham	R. Tyrer, Esq., B.A., F.M.S.	3·03	s)·48	20	18	52·0	3	13·5	22
WILTSHIRE.									
Marlborough	Rev. T. A. Preston, M.A.	3·67	·93	9	15	49·8	3	24·4	22
SHROPSHIRE.									
Woolstaston	Rev. E. D. Carr	4·11	1·15	9	20	49 5	3	21·5	28
Stokesay		4·03	·87	9	18	50·6	10	13·9	28
More Rectory, Bishop's Castle	Rev. A. Male	4·18	1·02	9	21	53·0	4	18·0	25
Bishop's Castle	E. Griffiths, Esq	4·64	1·13	9	20	50·0	3 & 9	19·0	28
Cardington	Rev. Wm. Elliot	3·44	1·11	7	19				
HEREFORDSHIRE.									
Stoke Bliss	Rev. G. Alexander	4·40	1·71	8	13	50·0	2, 3, 4	25·0	23, 24,27
WORCESTERSHIRE.									
Orleton, Tenbury	T. H. Davis, Esq., F.M.S.	3·46	·63	9	19	52·0	3	22·5	7
West Malvern	A. H. Hartland, Esq.	3·84	·78	9	19	49·0	3	20·0	28
Evesham	T. J. Slatter, Esq.	3·46	·81	14	20	51·5	3	24·5	7
Bewdley	J. M. Downing, Esq.	3·19	·60	10	15				
Pedmore	E. B. Marten, Esq.	3·01	·56	7	16	51·0	17	12 0	23
Stourbridge	Mr. I. Jefferies	2·83	·69	7	14	50·0	3 & 4	23·0	23 & 24
Dudley	Mr. C. Beale	2·58	·40	9	18	48·0	3	22·0	28
STAFFORDSHIRE.									
Dennis, Stourbridge	C. Webb, Esq.	2·69	·58	7	16	51·0	3	22·5	25
Kinver	Rev. W. H. Bolton	2·70	·58	7	16	49·0	3 & 8	23·0	28
Walsall	Mr. N. E. Best	2·92	·58	7	17	48·0	3 & 4	21·0	28
Lichfield	Mr. J. P. Roberts	3·53	·92	7	14	54·	5	23·0	7 & 24
Grammar School, Burton	C. U. Tripp, Esq., M.A.	4·39	·77	7	20	51·0	3 & 4	23·0	7 & 28
Weston-under-Lyziard	Hon. and Rev. J. Bridgeman	2·92	·67	7	19	51·0	3 & 4	20·0	28
Wrottesley	E. Simpson, Esq.	2·88	·51	7 & 9	15	49·8	4	21 5	28
Tean	Rev. G. T. Ryves, M.A.	5·21	1·16	7	18	49·4	4	21·0	6 & 23
Heath House, Cheadle	J. C. Philips, Esq., J.P.	5·39	1·09	7	17	48·7	10	22·1	28
Oakamoor	Mr. E. E. Kettle	6·22	1·36	7	15	49·8	10	20·3	7
Farley, near Cheadle	C. L. Wragge, Esq., F.M.S.	5·79	1·07	7	17	48·7	10	24·1	28
Beacon Stoop, Weaver Hills	C. L. Wragge, Esq., F.M.S.	2·86	·62	7	16	46·8	3	20·6	28
Alstonfield	Rev. W. H. Purchas	7·23	1·86	7	11	48·0	3	14·5	24
WARWICKSHIRE.									
St. Mary's College, Oscott	R. Pate, Esq.	2·80	·39	9	17	49·5	3	22·8	24
Henley-in-Arden	T. H. G. Newton, Esq	4·26	·80	9	18	51·0	3	24·0	28
Park Hill, Kenilworth	T. Hawley, Esq.	4·33	·94	14	14	51·0	3	24·2	7
Coundon, Coventry	Lieut.-Col. R. Caldicott	4·69	·80	7	19	49·0	3 & 4	22·0	28
Bickenhill	J. Ward, Esq.	3·99	·50	14	14				
Rugby School	Rev. T. N. Hutchinson	3·81	·86	9 & 15	18	50·0	3, 4, 17	24·0	24
DERBYSHIRE.									
Buxton	E. J. Sykes, F.R.A.S	8·07	1·56	7	16	47·3	3	15·9	7 & 25
Stoney Middleton	Rev. U. Smith	3·09	·98	9	11	48·0	3	18·0	28
Fernslope, Belper	F. J. Jackson, Esq.	5·57	1·12	7	17	50·0	4	24·0	7 & 24
Linacre Reservoir	C. E. Jones, Esq.	4·88	1·00	7	20				
Spondon	J. T. Barber, Esq.	4·76	·88	9	18	51·0		20·8	28
Duffield	W. Bland, Esq.	5·78	1·05	14	17				
NOTTINGHAMSHIRE.									
Trent College	Rev. T. F. Fenn, M.A.		·78	14	15	54·0	4	20·0	28
Park Hill, Nottingham	H. F. Johnson, Esq.	4·85	1·12	14	19	49·4	4	23·9	28
Hodsock Priory, Worksop	H. Mellish, Esq., F.M.S.	3·77	·72	14	21	52·7	4	23·3	24
Tuxford	J. N. Dufty, Esq., F.G.S.	4·32	·87	9 & 21	20	48·0	4	21·0	28
LEICESTERSHIRE.									
Loughborough	W. Berridge, Esq., F.M.S.	3·48	·80	7	17	51·9	4	25·7	7
Syston	J. Hames, Esq.	3·31	s)·50	7	19	50·0	5	24·0	24
Leicester	H. Billson, Esq.	3·69	·71	7	18	52·0	17	24·8	7
Town Museum, Leicester	M. Browne, Esq., F.Z.S.	3·63	·67	7	18	51·0	3	26·5	24
Ashby Magna	Rev. E. Willes	3·15	·53	7	17	51·0	4		
Kibworth	T. Macaulay, Esq.	3·33	·65	7	19	51·0	4	25·0	28
Waltham-le-Wold	E. Ball, Esq.	4·75	·71	9	19	46·0	3	20·0	28
Dalby Hall	E. Jones, Esq.	3·11	·46	9	16	47·0	17	21·0	7
Coston Rectory, Melton	Rev. A. M. Rendell	3·43	·78	9	18	49·8	4	21·3	7
NORTHAMPTONSHIRE.									
Towcester	J. Webb, Esq.	2·74	49	7	18				
Castle Ashby	R. G. Scriven, Esq.	2·73	·56	7	14	52·0	3 & 4	25·0	28
Kettering	J. Wallis, Esq.	3·20	·65	9	17	50·0	4 & 5	27·0	7 & 27
Althorp	C. S. Groom, Esq.	2·87	·54	9	17	49·0	3	22·0	6 & 28
OXFORDSHIRE.									
Ratcliffe Observatory	E. J. Stone, Esq., M.A.	2·78	·78	10	18	52·0	4	25·5	28
RUTLAND.									
Northfields, Stamford	W. Hayes, Esq.	2·52	·38	14	12	47·0	18	27·0	24
Uppingham	Rev. G. H. Mullins, F.M.S.	2·81	·61	14	18	48·7	4	26·1	28
OUTPOST STATIONS.									
Spital Cemetery, Carlisle	I. Cartmell, Esq.	2·85	·48	3	12	54·3	5	19·8	12
Scarborough	F. Shaw, Esq., F.M.S.	3·13	·43	10	21	49·5	4	29·8	28
Blackpool (North Shore)	C. T. Ward, Esq., F.M.S.					49·2	3	27·1	7
,, (South Shore)		4.31	·89	7	16	49·1	3	24·5	25
Llandudno	J. Nicol, Esq., M.D., F.M.S.	3·05	4·77	9	15	53·6	18	28·0	25
Carmarthen	G. J. Hearder, Esq., M.D.	5·38	·88	9	16	55·2	16	21·8	25
Altarnun, Cornwall	Rev. J. Power, M.A.	6·65	1·37	10	15	57·0	15	20·0	28
Sidmouth	W. T. Radford, Esq., M.D.	4·92	1·11	14	17	52·7	2	26·3	28
Ventnor	J. Codling, Esq.	4·14	1·03	23	9	53·4	8	27·0	28
Ramsgate	Rev. T. E. Egan, O.S.B.	1·78	·34	21	25	50·4	8	27·2	13

Although the Snowdon pattern gauge is in use, the Beacon Stoop rainfall values must, nevertheless, be regarded with considerable caution, owing to driving snow and heavy gales. In consequence, the minimum index-needle became occasionally displaced; but 20·6 as the *lowest* value may be, I think, safely accepted.

C. L. W.

To review more closely: The depression coming up on the 3rd and 4th, with light southerly winds, veering south-westerly, brought the maximum temperature at most of our Midland stations, and also on the N.-W. coast; and the succeeding crest passed with north-westerly airs on the night of the 6th. A new cyclonic disturbance immediately followed, with S.-E. (veering W.) gales; a remarkable fall of the barometer set in, with heavy snow and rain, and pressure in North Staffordshire decreased 1·037 within the 36 hours ended 9 a.m., 8th. At this time the central area was crossing to eastward, accompanied by heavy west gales, and continued downpour—hail, rain, and snow—with thunder and lightning occurring at Stroud. A rise to a well-marked, sharp summit in a.m. of the 9th followed; and forthwith, very suddenly, another cyclonic area approached and passed like its predecessor to northward, with the usual veering of the wind, bringing a whole gale from westward in the forenoon of the 10th, another torrent of rain,—and hail, thunder and lightning in Northamptonshire. With an unusual rise of 1·235 inch in 36 hours (as recorded at Farley) this last depression cleared off; a gentle fall succeeded, with snow, and a somewhat shallow disturbance crossed on the 14th, with more rain. Especially dull and foggy conditions ruled the third week, followed by heavy snow on the 21st and 22nd; slight snow showers occurred during the last few days; while covering the whole of this second period pressure held comparatively steady with the anti-cyclonic type more or less shewing up to northward; hence the atmosphere was not then subject to such spasmodic changes, and we experienced, *generally*, calms and light variables. Temperature was very unsteady, and below the average. Spells of frosty weather occurred about 2nd, 7th, 12th, 13th, and from 19th to end: the periods of maximum were well marked on the 3rd, 4th, 10th, and 17th. The entire month was singularly dull and cloudy, Mr. Mellish reporting from Nottinghamshire but a total duration of sunshine of 37 hours, or an average of 1·3 hour per day. The rainfall was largely in excess, and the cyclonic storms, before referred to, caused serious floods in the basins of the Trent and Severn. Ozone largely present, as appears usual at the advent of Spring:—maximum registrations taking place at Farley on 7th, 10th, 13th, and 19th, and only on three days did the test papers fail to respond; at Carmarthen the *mean* amount was 5·0. A rather brilliant aurora was seen at Cheltenham on the 6th, and a red one at Burton on the 19th. On the former day a great spot centre, with *umbræ* very black, was coming up, in perspective, on the sun's east limb, and during the third week some fine spot detail was to be observed—the coincidence is at least interesting.

Correspondence.

APPROXIMATE PHENOLOGICAL DATES.

As a guide to observers the Meteorological Society has drawn up the following table, giving approximately the times of appearance of plants, insects, and birds. In the case of plants, those persons who cannot observe the whole number are requested to pay especial attention to those of which the names are printed in capitals. Observers are respectfully requested to comply with the rules laid down in Messrs. Grove and Bagnall's paper at page 15 of the present

Volume; and to send their notes and specimens as early each month as possible to Mr. W. B. Grove, B.A., Franchise Street, Perry Barr, Birmingham, who has undertaken to collate them.

APRIL.

No. in List.	Averag. Date.	*Plants.*	Earliest.	Latest.
30	1	*Anthriscus sylvestris* (Cow Chervil)	Mar. 16	April 21
7	6	*Cardamine pratensis* (Cuckoo-flower)	Mar. 12	April 22
12	9	*Stellaria Holostea* (Greater Stitchwort)..	Mar. 25	April 24
71	11	SCILLA NUTANS (Blue Bell)	Mar. 31	April 22
52	15	*Veronica Chamædrys* (Germander Speedwell)............................	Mar. 12	May 4
62	18	*Plantago lanceolata* (Ribwort Plantain)..	April 3	April 28
3	19	*Ranunculus acris* (Upright Crowfoot)	April 5	May 15
20	22	*Vicia sepium* (Bush Vetch)..............	April 14	May 5
50	24	*Symphytum officinale* (Comfrey)..........	April 16	April 30
10	28	*Polygala vulgaris* (Milkwort)	April 18	May 7
60		*Ajuga reptans* (Bugle)..................	April 15	May 5
16	30	GERANIUM ROBERTIANUM (Herb Robert)..	April 27	May 4

Insects and Birds.

75 *Pieris Brassicæ* (Large White Cabbage-Butterfly.)
78 *Bibio Marci* (St. Mark's Fly.)
84 *Daulias luscinia* (Nightingale) song begins.
92 *Hirundo rustica* (Swallow) first seen.
91 *Cuculus canorus* (Cuckoo) first heard.

PLANTS IN BLOSSOM IN SOUTH BEDS, January 1st, 1881:—

NAME.	SOIL, SITUATION, &c.
*Mercurialis perennis!	Sandy hedge bank, S.W.
Bellis perennis	Chalk, hill-side, W.
Taraxacum dens-leonis	Ditto ditto.
Cerastium triviale	Rubbish heap.
Ranunculus repens	Chalk, fallowfield.
Petasites fragrans!	Weed of cultivation.
Senecio vulgaris	Common.
Capsella bursa-pastoris	Ditto.
Ulex europæus	Road-side, sandy soil.

* A late autumn blossoming.

J. S., Luton.

PHENOLOGICAL NOTES made in walks in the neighbourhood of Burton-on-Trent, March, 1881.

March 12th.
Humble Bee appearing.
Arum maculatum (common Arum) coming up.
Rumex obtusifolius (common Dock) coming up.
Carduus nutans (Musk Thistle) in leaf.
Scilla nutans (Wild Hyacinth) sprouting.
Oxalis Acetocella (Wood Sorrel) in bud.
Cratægus oxyacantha (Hawthorn) budding.
Lonicera Periclymenum (Honeysuckle) in leaf.
Corylus Avellana (Hazel) in full flower, both stamen and pistil [bearing blossoms.
Salix (common Willow) catkins appearing.
Galanthus nivalis (Snowdrop) in full bloom.
Ranunculus Ficaria (Celandine) in flower.
March 19th.
Anemone nemorosa (Wood Anemone) sprouting.
Mercurialis perennis (Dog's Mercury) nearly in flower.

F. E. TRIPP.

[Kindly send plants with future notes.—W. B. G.]

Abnormal Growth of Araucaria imbricata.—In the garden before the house, 61, Moor Street, Burton-on-Trent, is an *Araucaria imbricata* of abnormal growth. The top having been broken off about a foot from the ground, one of the side shoots from immediately below the fracture has grown to a height of about 15 feet. It might at first be taken for the fully developed tree, but, on examination, it appears that instead of the branches having two side shoots, as is usually the case, many of them are simply furcate at the ends, thus showing that the powers of the tree were not quite equal to the strain upon them. The original summit has also thrown out several short branches a few inches long.—F. E. Tripp, Burton-on-Trent.

Mercurialis perennis.—The observation of the flowering of this plant, December 26th, 1880, which was recorded on page 68, may, I think, be fairly accepted as an instance of late autumn flowering of this species. The plants were of vigorous habit, ranging from 18 to 24 inches in height, with foliage fully developed, and the pistillate ones could be easily distinguished by the more compact arrangement of the leaves on the tops of the stems. The staminate plants had been in blossom some time, as the lower flowers of the spikes had expanded and fallen off. A second visit to the same station on March 13th confirmed the previous impression. Attached to the same roots were to be seen both the dead stalks of the December growth, and the fresh young green ones of the present spring, just opening their flowers. Herewith are sent some of each kind, and amongst the dead leaves of the former, which were killed by the excessive cold of January, may still be distinguished the shrivelled rachises of the spikes that blossomed in December.—J. S., Luton.

Reports of Societies.

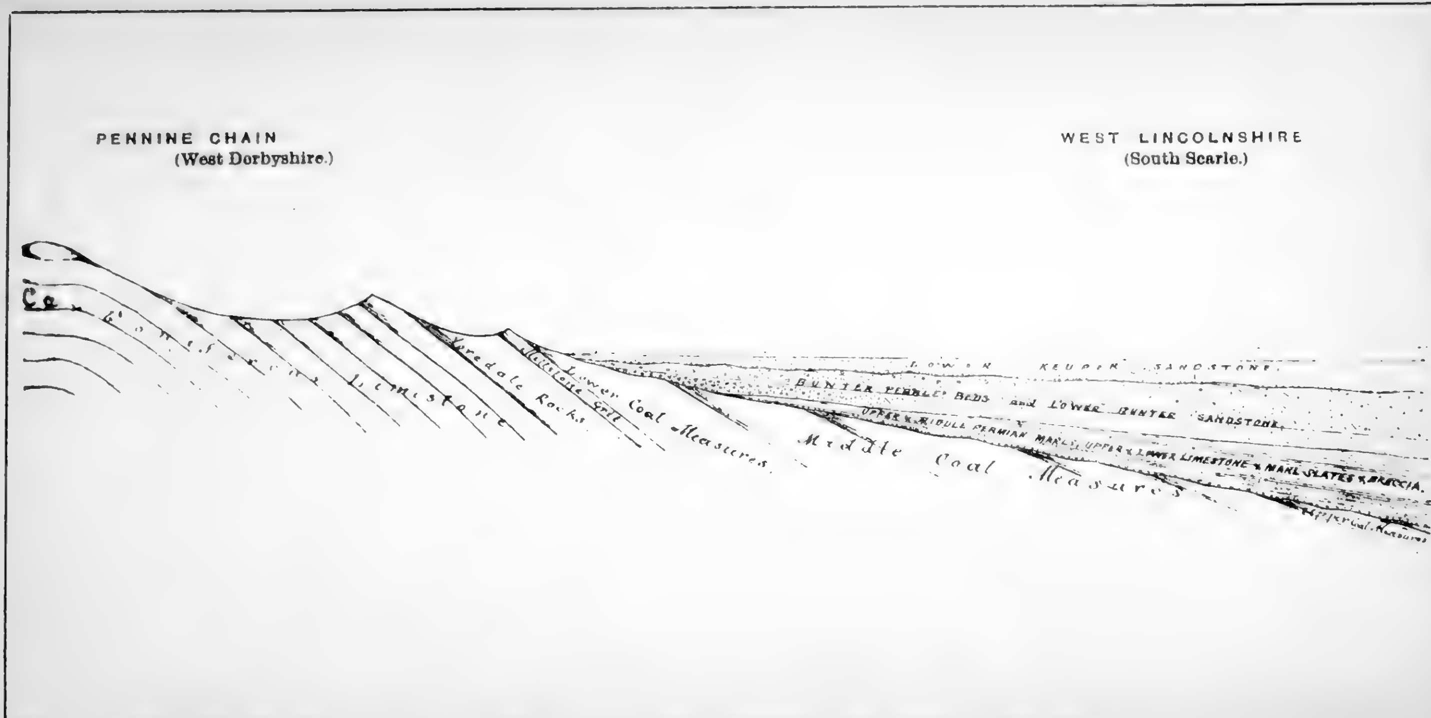
BIRMINGHAM NATURAL HISTORY AND MICROSCOPICAL SOCIETY.—Geological Section.—February 22nd. At this meeting Mr. W. J. Harrison, F.G.S., was elected president and Mr. A. H. Atkins, B.Sc., secretary for the ensuing year. Mr. Atkins then read a paper on "The Triassic Rocks" of the Midland Counties. He first gave a brief account of the researches made during the present century in these beds, which occupy the greater part of the centre of England. He then described the distribution, lithological characters, and contents of the various divisions, and the manner in which they are supposed to have been formed. An animated discussion followed, principally on the origin of the Bunter Conglomerate, and the cause of the peculiar indentations and cracks which are characteristic of these pebbles.—March 1st. Mr. W. G. Fretton read a paper on "Museums, in relation to their value in manufacturing centres," in which he dwelt strongly on the fact that the character of a museum should accord with the nature of the locality where it was formed. Thus, in a rich historical neighbourhood, antiquities should predominate; in a good geological district, fossils; and so, in a manufacturing centre, the chief part should be occupied by a collection illustrating the staple industries of the place. Foreign and ancient specimens of the same or similar processes should be exhibited, as a fund from which the native artisan could draw new ideas as to form, colour, or ornamentation. —March 8th. Mr. S. H. Parkes delivered an interesting lecture on "The Moon," illustrated with the oxy-hydrogen lantern, to a very numerous and attentive audience. Among other things, he referred to the supposed influence of the moon upon the weather and the occurrences of human life, and stated that accurate scientific investigation had proved that such a connection had no existence in fact. He gave descriptions of the various phenomena presented by the lunar surface; and some beautiful photographs, by which these were delineated in a very striking and realistic manner, were exhibited on the screen. A hearty vote of thanks was afterwards passed to the lecturer. —MICROSCOPICAL GENERAL MEETING.—March 15th. Mr. Hughes exhibited *Trichina spiralis*, from the muscles of man and a pig, and made a few remarks, in which, while he deprecated the present scare on this subject, he advised the most thorough cooking of every preparation of pork. Mr. Bolton exhibited a number of marine organisms from the Aston Aquarium. Mr. Lloyd exhibited a section of the stem of a species of Bignonia. Mr. Bagnall exhibited two rare mosses, *Fissidens incurvus* and *F. exilis*, from New Park, Middleton; also a fine series of the aquatic Ranunculi of Warwickshire, giving details of their distribution and their specific differences. Mr. Levick read a note upon *Volvox globator*, in which he described several experiments, which he believed to prove the Volvox sphere to be filled with a substance little or no less solid than the peripheral envelope. This conclusion was much controverted by some of the members present, and Mr. Levick promised to demonstrate the fact to their satisfaction on some future evening.

BANBURYSHIRE NATURAL HISTORY SOCIETY AND FIELD CLUB.—A society, named as above, has recently been formed at Banbury, under most favourable circumstances. A provisional committee made excellent arrangements for the opening meeting, (which was fully attended,) and secured the use of a number of microscopes, and, among other exhibits, a fine stand of rare local birds, (by Mr. O. V. Aplin,) geological and botanical specimens, land shells, and butterflies. Mr. T. Beesley, F.C.S., was elected president, and delivered a suggestive, practical address, in the course of which he strongly recommended ladies to take up the study of meteorology, and devote special attention to the observation of cloud forms, valuable records of which, with the aid of pen and pencil, they might easily accumulate. The scope afforded by the district to students of the several branches of natural history was also pointed out. It was announced that nearly fifty members had been enrolled. Mr. E. A. Walford was elected honorary secretary. The first ordinary meeting of the society was fixed for Monday, April 4th, at Wood Green Lodge, when Mr. Aplin will read a paper entitled "Ornithological Observations."

BURTON-ON-TRENT NATURAL HISTORY AND ARCHÆOLOGICAL SOCIETY.—February 15th. A paper was read by the Rev. Clement Ley, M.A., F.M S., Rector of Ashby Parva, on "Clouds and Weather." Mr. Ley said that a science of clouds did exist, and pointed out its practical utility. An experienced observer of the forms and movements of clouds, aided by meteorological instruments, is able to tell with considerable accuracy the state of the weather at the time of observation for 400 miles all round the station at which the observation is made. At, or just after sunrise, he is enabled to foretell the coming weather of the next twelve hours at his own station, with 95 per cent. of successful forecasts. It enables him to predict at, or after sunset, the weather of the next coming 24 hours at his own station, with 75 per cent. of successful forecasts. He said this amount of accuracy was not to be found in the forecasts of the Meteorological Office, because that office undertakes to forecast local weather from general observations, which are purely instrumental, without the information to be had from the forms and movements of the clouds at the localities for which forecasts are issued. The local scientific observer can predict for himself the coming weather better than any central office. Mr. Ley also discussed—What are clouds? Into what distinguishable varieties are they divided? And to what condition of present and coming weather are these varieties or genera related? To make the subject more instructive, he exhibited explanatory diagrams by means of the oxy-hydrogen lantern.

EVESHAM FIELD NATURALISTS' CLUB. — February 23rd, the annual meeting, which was well attended. The treasurer's account showed a small balance in hand, although the club funds had suffered a loss on the excursions during the year. The committee's report stated that the number of members is thirty-two, as compared with twenty-eight last year. The usual indoor meetings were held during last winter, when interesting papers were read to fair attendances of members. The following were the papers contributed:—"Microscopical Organisms," illustrated by specimens taken from the River Avon, by Mr. T. J. Slatter, F.G.S., president; "Some of the British Papilionaceæ," by Miss Edith New; and "Certain New and Old World forms of Bats," by Mr. R. Fisher Tomes, F.G.S. Fewer excursions than usual have taken place, owing to the disturbed state of the town by reason of the elections and petitions, but the following places have been visited, viz.:—Oddington Wood, near Addlestrop; Stanway, Snowshill, and Oversley Wood, near Wixford. The following are among the rarer plants found during the past year:—*Thlaspi perfoliatum*, *Anemone Pulsatilla*, *Senecio arvensis*, *Myriophyllum verticillatum*, *Peplis Portula*, *Cerastium arvense*, *Centunculus minimus*. A cordial vote of thanks was given to the retiring officers, especially to Mr. Geoffrey New, who has for several years filled the office of hon. secretary. The following members were elected officers for the ensuing year:—President, Mr. T. J. Slatter, F.G.S.; treasurer, Mr. J. S. Slater; secretary, Mr. T. E. Doeg; assistant secretary, Miss L. E. Martin; committee, Mrs. Martin, Messrs. A. H. Martin, G. New, and F. Wright. Mr. R. Fisher Tomes, F.G.S., then read an interesting paper on "The Typical and Subtypical Plumage of Certain Groups of Birds," for which he received the hearty thanks of the meeting.

OXFORDSHIRE NATURAL HISTORY SOCIETY.—February 9th.—A meeting was held in the Lecture Hall, Botanic Gardens, Oxford, Professor Westwood, F.L.S., in the chair. The Secretary (Mr. G. C. Druce) read a communication from Mr. Milner, of Queen's College, on the early flowering of plants, from which it appears that the Hazel, Alder, Ivy-leaved Speedwell, Primrose, and Barren Strawberry were all noticed in flower earlier this year than in 1880 or 1879. Notice was given that the society had joined the Midland Union of Natural History Societies, and that a prize had been offered by the President of the Union, Sir Herewald Wake, Bart., for the best original life history of any genus of insects indigenous to the Midland district, and also that the Darwin medal offered this year was for a geological memoir. Professor Westwood briefly addressed the meeting. G. B. Poulton, Esq., M.A., then gave a lecture on "The River Valleys of Oxford," lucidly explaining the manner in which the river had cut its way first through the thin layer of high-level gravel, composed of masses of quartzite, probably carried by icebergs from the mountains of Wales, Scotland, or even Scandinavia, which had dropped their burden when melting in a shallow sea, which at that time—towards the end of the glacial epoch—covered this portion of our island. Afterwards the land was gradually upheaved, the rivers began to flow, and in flowing commenced that system of denudation which resulted in cutting through, not only the thin layer of high-level gravel, which might be seen capping Wytham Hill, but also through the coralline oolite, which once stretched from Wytham across to Elsfield, both hills being formed of this substance. This denudation left behind confirmatory evidence in the layer of more recent gravel which at present stretches across the valley in an almost uninterrupted course, coming to the surface at Binsey, and on the tongue of land which forms the watershed of the Cherwell and Isis, on which Summertown and the Ports are situated, while it is covered on the depressions of Port Meadows and the Cherwell Meadows by clay or alluvial deposit of more recent formation. Mr. Poulton illustrated his lecture by diagrams, and further explained the differences between the high-level and low-level gravel, the fossil and organic constituents of the more recent alluvial deposit and of the olden Oxford clay and the physical appearance of the old river, which at one time assumed the appearance rather of a chain of lakes than a river, and that the water cutting through, as at Sandford, &c., gradually drained the lakes of which Port Meadow might be taken as a type.—A hearty vote of thanks was given for the lecture.—Afterwards, a number of exhibits were made, including a living Shore Lark, by Mr. Macpherson, of Oriel College; several stained sections of Lavatera and Acacia, by Mr. J. Wright; specimens of *Dracæna Draco*, &c., by Professor Lawson; and three Oxfordshire roses, *Rosa aspernata*, *Kosinciana*, and *andegavensis*, by the Secretary.



Ideal Section to Illustrate the Pre-permian Age of the Pennine Chain, and its persistence as a Physical Barrier in Permian and Triassic Times.

THE PERMIAN FORMATION IN THE NORTH-EAST OF ENGLAND,

WITH SPECIAL REFERENCE TO THE PHYSICAL CONDITIONS UNDER WHICH THESE ROCKS WERE FORMED.

BY E. WILSON, F.G.S.

Our knowledge of the Permian rocks of the north-east of England may be said to date from the publication of the now classical work of the late Adam Sedgwick, on "The Geological Relations and Internal Structure of the Magnesian Limestone," in the year 1829 *(a.)* Since that time many valuable memoirs have been written by Messrs. King, Kirkby, Ramsay, Howse, Sorby, Ward, Green, Lucas, and others, on the physical structure, geological classification, and palæontological characteristics of this extremely interesting and important group of rocks; so that, at the present day, comparatively little remains to be learnt on these heads. When, however, geologists have come to speculate as to the mode of formation of the magnesian limestone, a considerable diversity of opinion is at once apparent among them. Some authors, Prof. Ramsay and Dr. T. Sterry Hunt, for instance, have suggested that these dolomitic limestones were *chemically formed* originally, having been precipitated from concentrated solutions in inland salt lakes, while others, of whom the most prominent is Dr. Sorby, have come to the conclusion that the magnesian limestone agrees with most other limestones in having had an *organic* origin, and that the original structure has since been in great measure obliterated by mineral infiltrations, and chemical decompositions and recrystallisations, or that, at any rate, it owes its *origin* partly (and *largely*) to organic and partly to chemical processes.

In the following essay my chief aim will be to put forward a feasible hypothesis to account for the origination of the peculiar group of deposits that constitute the Permian formation in the north-east of England. In order, however, to supply the necessary basis of fact on which I ground my theoretical conclusions, it will, in the first place, be necessary to describe, in some detail, the mineral character and distribution, the thicknesses, and fossil contents of the various sub-divisions of the Permian series in their range, through the counties of Durham, Yorkshire, and Notts.

For much of the information here given I am of necessity largely indebted to the labours of others. At the same time I shall myself contribute several new facts—the results of my work among these rocks for many years past—that have a direct bearing on the very difficult problem of the mode of origin of these rocks.

Geographical Distribution, etc.

The Permian rocks of the north-east of England, or rather the narrow fringe of those rocks exposed at the surface along their western

(a) Trans. of Geol. Soc., London. 2nd Ser., vol. iii., pt. 1., p. 37.

outcrop (the only portion, of a doubtless extensive Permian area, that is open to our inspection) occupy a long, narrow, and fairly rectilinear band of country which ranges N.N.W. and S.S.E. from the coasts of Durham on the north to the town of Nottingham on the south, and separate the triassic rocks on the one (east) hand from the carboniferous rocks on the other (west.) From Nottingham to Watlas, Bedale, in the north-riding of Yorkshire, this band of Permian rocks, though very fluctuating in width and rarely more than five miles across, is unbroken, though in the northern part of its range the magnesian limestone occupies a very narrow tract of country. Between Bedale and the valley of the Tees west of Darlington, triassic rocks overlap the Permian deposits, and rest on millstone grit and Yoredale rocks, the magnesian limestone only showing at the surface in certain outliers between Bedale and Richmond. Northwards from the Tees the magnesian limestone ranges through Durham, broadening out so as to occupy most of the eastern portion of that county from Hartlepool and Pierce Bridge on the south, to South Shields and Tynemouth on the north. The western boundary of the magnesian limestone is well defined and usually forms an abrupt and often lofty escarpment, overlooking the low undulating lands of the Coalfields of Yorkshire and Durham, and the bolder contour of the millstone grit country intervening.

The summit of the escarpment being reached, we find an extended plain gradually declining towards the east, and in a general way the slope of the ground will be determined by the dip of the beds. The eastern boundary of the magnesian limestone is not well defined. In many places it is covered by thick deposits of drift, and its junction with the overlying triassic rocks is rarely visible; when seen, however, (as, for instance, in the Cinderhill and Bestwood quarries, near Nottingham) a certain want of conformity is apparent between the two series, and this unconformability is also inferred from the southerly and westerly overlaps of Permian by triassic rocks. *(a.)*

Looking at the present distribution of the Permian rocks of the north-east of England, a fact that strikes us at once is the pronounced unconformability between the Permian and the Carboniferous rocks. In its range from Nottingham to Tynemouth the magnesian limestone overlaps two coalfields—the Yorkshire and the Durham; for a considerable part of the distance, it is true, the trend of the magnesian limestone escarpment runs parallel with the north and south strike of the measures of these coalfields, but when we reach the confines of these basins, in particular the northern limits of the great Yorkshire coalfield and the southern extremity of the Durham, the true unconformability of the Permian and carboniferous systems

(a) It is to be noted, however, that an exaggerated notion of the amount of unconformity between the two formations may be thus obtained. The overlap takes place in the directions in which the Permian rocks, as I shall presently shew, naturally attenuate, thus the absence of certain of the Permian members on the south and west is due less to their subsequent denudation than to their original attenuation.

at once becomes apparent, the magnesian limestone gradually overlapping the coal measure strata in succession, until at length it comes to repose directly on millstone grit. Through the intervening millstone grit country run many anticlinals approximately east and west, which pass under undisturbed magnesian limestone. Several large faults do the same. In the coal measure districts, too, we find that even where the strike is the same there is still a more or less perceptible difference in dip between the carboniferous and the Permian strata. This is sometimes shewn in open cuttings, and is inferred from the increased depths at which particular coal seams are found beneath the base of the Permian rocks, as we go east from the vicinity of the magnesian limestone escarpment in Yorkshire, and north-east from the southern margin of the limestone area in Durham.

The above facts clearly show that, before the commencement of the Permian epoch, the carboniferous and older palæozoic rocks of the north of England had been subjected to powerful earth movements both along the north and south and east and west axes of upheaval, followed by long continued and extensive denudation. It was then that the Pennine chain, that range of high ground which stretches from mid-Derbyshire to the borders of Scotland, was elevated, and afterwards so deeply denuded, that rocks as low down in the series as mountain limestone were laid bare in the heart of the chain. *(a)* See Plate VI.

Before proceeding to describe the Permian rocks of the north-east of England, I shall, in the first place, notice a rock (or rather a structure assumed at times by very various rocks) that was formerly classed with the Permians, but is now pretty generally understood to belong to the carboniferous system.

LOWER RED SANDSTONE OR ROTHLIEGENDE :—CARBONIFEROUS ROCKS.

Beneath the magnesian limestone, along its western escarpment, are a number of beds of incoherent yellow sand and beds of sandstone and shale, which in many cases are coloured of a deep red by oxide of iron. Such, for instance, are the extensive beds of yellow sand and red sandstone, so frequently found skirting the magnesian limestone escarpment in Durham; and the Plumpton sandstone or Knaresboro' grit, and the Rotherham red rock in Yorkshire. These beds were originally classed by Drs. Smith and Sedgwick as "lower red sandstone"—the Rothliegende of Murchison. Later researches, however, by several accurate observers, such as Messrs. Howse, Binney, Ward, Lucas, *(b)* and others, have made it clear that these rocks belong, not

(a) The Age of the Pennine Chain. E. Wilson, F.G.S., Geol. Mag., vol. vi., p. 500. (Brit. Ass.) Midland Naturalist, vol. iii., pt. 1. 1880.

(b) On the so-called Lower Red Sandstone of Central Yorkshire, by E. W. Binney, F.R.S., F.G.S. Geol. Mag., vol. iii., 1866, p. 49. On beds of Supposed Rothliegende Age near Knaresboro', &c., by J. C. Ward, F.G.S., Q.J.G.S., vol. xxv., p. 291. On the Permian Beds of Yorkshire, by Joseph Lucas, F.G.S. Geol. Mag., 1872, p. 338. Notes on the Permian System of Durham and Northumberland, R. Howse, 1848. West Yorkshire, by Davis and Lees, 1878, p. 176. Geology of the Yorkshire Coldfield. Mem: Geol. Survey, 1878, p. 481. Geology of parts of Notts, Yorkshire, and Derbyshire, by W. T. Aveline. Mem. Geol. Survey, 2nd Ed., 1880, p. 12.

to the Permian, but to the carboniferous system, for they have shown that the magnesian limestone is unconformable to the strata beneath; that these red rocks and the limestone often strike in different and sometimes in diametrically opposite directions; that, except in local cases, these underlying sandstones and shales have the common characteristics of, and are perfectly conformable to, the rocks of the carboniferous formation; and that they often contain characteristic coal plants, or carboniferous marine mollusca. Neither also in Notts or Derbyshire, either west of the magnesian limestone escarpment, or in vertical explorations for coal to the east, have any red sandstones or other rocks that could possibly be considered "Rothliegende" been met with at the base of the Permian rocks. The marl slates with their basement breccia are the lowest Permian strata in this district we know anything about. The narrow fringe to the magnesian limestone coloured on the geological survey maps as "lower red sandstone" really consists of these last-named rocks; while the two small areas similarly coloured between Derby and Ilkeston, as I have heretofore shown, consist in one place (Morley) of brecciated lower bunter sandstone and purple lower coal measure shales, and in the other (Dale Mill) of massively bedded lower coal measure sandstone. *(a)*

The study of this subject shows that in our district the following very dissimilar rocks have, at one time or another, been mistaken for "Rothliegende," viz., millstone grit, lower, middle, and upper coal measure sandstones and shales, marl slates, and breccia, and lower bunter sandstone and breccia, in fact almost every imaginable coarse or red rock belonging to the contiguous formations, the horizon of which had not at the time been clearly defined. I venture to affirm that, with the exception of the marl slate breccia in Notts, and the very thin and local deposits of quicksand in Yorkshire and (?) Durham, there are *no* coarse, or red, or yellow coloured Permian rocks beneath the magnesian limestone. Whatever may eventually turn out to be the case with the "lower red sandstones" in other parts of England, the "Rothliegende" of the north-east of England must certainly be considered as a thing of the past.

Classification.

The Permian rocks of the north-east of England are now generally classified as follows:—*(b)*

Upper Permian Marls.
Upper Magnesian Limestone.
Middle Permian Marls.
Lower Magnesian Limestone.
Marl Slates.
Quicksand.

I now proceed to describe these sub-divisions as they exist in the above area, beginning with the lowest and oldest.

(a) On the Uncomformability of the Keuper and Bunter, by E. Wilson, F.G.S., Geological Magazine, vol. vii., 1880, p. 308.

(b) This classification holds good in a general way for Yorkshire and Notts, but requires modification for Durham. (See pp. 13-14.)

Quicksand.

Occasionally we find beneath the magnesian limestone, and resting on the underlying carboniferous rocks, certain local deposits of white or yellow false-bedded sand, which are never more than a few feet in thickness and are often absent altogether. It is not certain that this rock is present in *Durham*. The unconsolidated sand rocks that are so frequently seen beneath the magnesian limestone escarpment in that county are now properly classed with the carboniferous system. It is doubtful whether it has been met with in any of the colliery shafts sunk through the limestone. In *Yorkshire* these beds may be seen at several points along the limestone escarpment. At West Garforth, near Leeds, there are exposed beneath the thin-bedded lower limestone some ten or twelve feet of excessively current-bedded sand; the upper portion is very fine grained and used for moulding in iron making, the lower part is coarser and contains small rounded pebbles of white quartz. This deposit thins out rapidly S. or S.W. At Glass Houghton, between Pontefract and Castleford, from nine to twelve feet of white and yellow fine grained friable sandstone may be seen cropping out from beneath thin-bedded argillaceous limestone, which I take to represent the marl slates. Similar "quicksand" is shown in a small quarry at Scriven, near Knaresboro'. At the brick and pottery works, Conisboro', the section shows some eight or nine feet of blue clay and thin-bedded limestone (? marl slates,) resting on some six feet of gritty sand, with seams of breccia, ("quicksand,") which in turn rest upon an eroded surface of red marls and sandstones belonging to the upper coal measures. In the Shireoaks pits (on the borders of Notts and Yorkshire) at a depth of 213 feet, a light grey unconsolidated sandrock, varying from 1ft. 8in. to 7ft. 0in. in the two shafts was met with, which is considered as the bottom rock of the Permians and may represent the "quicksand." In some large open pits at Pebbly Dam, near Harthill, there are about twenty feet of loose yellow sand which may be the "quicksand." South of Shireoaks we have no equivalent of this peculiar deposit, unless the breccia at the foot of the marl slates presently to be mentioned may be taken to represent the "quicksand" of Yorkshire.

(To be continued.)

THE FLORA OF WARWICKSHIRE.
AN ACCOUNT OF THE FLOWERING PLANTS AND FERNS OF THE COUNTY OF WARWICK.

BY JAMES E. BAGNALL.

(Continued from page 81.)

R. sceleratus, *Linn.* *Celery-leaved Crowfoot.*

Native: By pools, ditches, and streams. Locally common. May to September.

I. Sutton Park; Duke's Bridge, near Coleshill; Marston Green; Berkswell, &c.

II. Abbotts Salford! *Rev. J. C.* Tredington! *Newb.* Near Bilton Church! *R. S. R.*,* 1877. Although I find this plant in every part of the county, it is often missing over large areas, and may be considered as common in some districts, local in others.

R. Flammula, *Linn.* *Lesser Spear-wort.*
Native: In ditches, marshes, &c. Very common. May to September. A variable species, widely spread in the county.

R. Lingua, *Linn.* *Greater Spear-wort.*
Native: In pools and streams. Very rare. July to September.
I. Sutton, *Freeman, Phyt.*, i., 262; in Sutton Park, abundant in Bracebridge and other pools.
II. In an old pit at Allesley, *Rev. W. T. Bree, Phyt.*, iii., 301; in a pit at Griff, near Nuneaton, *T. Kirk*; by the side of an old canal, near Coventry Wood; Fir Tree Grove, Arbury Park, *T. Kirk, Phyt.*, ii., 947; Snitterfield, *Cheshire.*

R. auricomus, *Linn.* *Goldilocks, Wood Crowfoot.*
Native: In woods and on shady banks. Locally common. April, May.
I. Sheldon! *Rev. J. Gorle;* Shustoke, Maxtoke, Elmdon, Knowle, &c.
II. Abbotts Salford, *Rev. J. C.*; Iddicote, *Rev. J. Gorle.* Coombe Abbey Woods, Allesley, Yarningale. Two forms occur often intermixed, and passing one into the other; a nearly apetalous form is often abundant, and is probably *R. depauperatus.*

R. acris, *Linn.* *Buttercup.*
Native: On banks, in meadows, and on waysides, &c. Common. May to August
Two varieties occur, var. *a. Steveni* being the most abundant form of the Tame basin; var. *b. vulgaris* is in some parts of the Avon district equally as abundant as the type form. These varieties are scarcely marked ones. The plant, as an aggregate, is widely spread in the county.

R. repens, *Linn.* *Creeping Buttercup.*
Native: In ditches, meadows, on heathy waysides, &c. Common. May to August. Common throughout the county.
Two marked forms are abundant—the one, a small, prostrate form, common on heathy waysides; the other, a robust form, often very rampant, in ditches.

R. bulbosus, *Linn.* *Bulbous Buttercup.*
Native: On banks, in meadows, and on waysides. Common. May to August.
Found throughout the whole area, but more local than the two preceding species.

R. hirsutus, *Curtis.* *Hairy Crowfoot.*
Native: In corn fields. Rare. May.
II. Corn fields, at Myton, *H. B.*
This plant cannot be regarded as more than a casual, having been probably introduced with foreign seed.

R. parviflorus, *Linn.* *Small-flowered Crowfoot.*
Native: In cultivated fields and on dry banks, in calcareous soils. Rare. May to August.
I. Bickenhill, *Bree*, "Mag. Nat. His.," iii., 165.
II. Top of Oversley Hill; hedge banks, near Alcester Mill, *Perry Fl.*, p. 46; between Hampton-on-the-Hill and Norton Lindsay,

* Abbreviation for Rugby School Society's Reports.

Herb. Perry; Hatton Rock, *Cheshire;* near Harboro' Magna, *Rev. A. B.;* near Little Lawford, *H. W. T.;* Milverton and Ashorn, *H. B.*

R. arvensis, *Linn.* *Corn Crowfoot.*

Colonist: In cornfields. Locally common. June, July.

I. Marston Green; Solihull; Lapworth; Hartshill, &c.

II. Whatcote, *Rev. J. Gorle;* common in Stour Basin, *Newb.;* Alcester, &c. Uncertain in its occurrence, will appear year after year with biennial crops, but often absent in the same fields when the crop is an annual one.

R. Ficaria, *Linn.* *Lesser Celandine, Pilewort.*

Native: In damp woods and meadows, on banks, &c. Common. March to May. Abundant throughout the county. The var. *divergens*, Schultz, is our only form.

CALTHA.

C. palustris, *Linn.* *Marsh Marigold.*

Native: In ditches, marshes, and similar places. Common. April to June. More or less abundant throughout the whole area. Var. *b. Guerangerii.*

I. Middleton; Sutton Park; Maxtoke; Marston Green; Blythe Bridge, Solihull.

II. Radford, *Y. and B.;* Binton Green, and Pinley, *H. B.*

Var. *c. minor* has been recorded on insufficient grounds.

[*Eranthis hyemalis*, Salisb. *Winter Aconite.* Occasionally found, but never as other than an introduced plant, or as a stray from cultivation. It occurs near the Parsonage, Curdworth! In the Hall field, Birdingbury, *H. B.;* and abundantly in Stratford churchyard, *Pratt.*]

HELLEBORUS.

H. viridis, *Linn.* *Green Hellebore, Bearsfoot.*

Denizen: In thickets and on hedge banks. Rare. February, March.

I. Allesley and Shustoke, *Bree, Purt.*, iii., 363! *Mag. Nat. His.*, iii., 164; Oldbury Hall.

II. In a field near Studley Castle, *Purt.*, i., 264; Grove Park, Hatton! *H.B.;* Dadley's Wood, Allesley, *Kirk;* Holywell, near Claverdon, 1878.

H. fœtidus, *Linn.* *Stinking Bearsfoot.*

Denizen: On banks and in meadows. Rare. February, March.

II. Studley Castle, Dunnington, Arrow, *Purt.*, i., 265; bushy pit at Rowington, *H.B.;* abundant, in 1874, in a field near Yarningale Common.

Both the above plants are fairly established in some of the localities cited, and apparently remote from gardens, but I do not think they are more than aliens in Warwickshire.

AQUILEGIA.

A. vulgaris, *Linn.* *Columbine.*

Native: In woods and thickets, and on banks. Rare. June, July.

I. Middleton Park, *Adcock;* Shelly Coppice and banks of the Blythe, near Solihull; Kingswood.

II. Corley Wood, *Bree, Purt.*, i., 256; Allesley, *Bree, Mag. Nat. Hist.*, iii., 165; Chesterton Wood, and bushy field near Kenilworth, *H. B.;* on banks near Henley-in-Arden.

[*Delphinium consolida*, Linn., is recorded by Purton, i., 255, from Studley, in the Castle field, but has no claim to a place in the county flora.]

ACONITUM.

A. Napellus, *Linn.* *Monkshood.*
Denizen: Near streams. Rare. June.
II. Fishers Brook, near Warwick, formerly abundant.
Mr. Bromwich considers this plant fully established.
Actæa spicata, Linn., Herb Christopher, was recorded in a note to me by the Rev. A. Bloxam from Harboro' Magna, in copses on Lias or calcareous soils.]

BERBERACEÆ.

BERBERIS.

B. vulgaris, *Linn.* *Common Barberry.*
Native: In thickets and hedges. Local. May, June.
I. Erdington, *Rev. J. C.;* Arley, near the village; ruins of Hartshill Priory.
II. Oversley, Grafton, Billesley, *Purt*, i., 180; Leek Wootton, Warwick, *Perry Fl., p. 32*, 1820; Stoneleigh, Tachbrook! *Y. and B.;* Harboro' Magna, *Rev. A. B.;* Norton Lindsay and Kenilworth, *H. B.;* near Little Lawford Mill, *R. S. R.*, 1878; Honington, *Newb.;* Ipsley! in several places, *Slatter.* This bush is so frequently planted that it is difficult to decide where it may be considered native.

NYMPHÆACEÆ.

NYMPHÆA.

N. alba, *Linn.* *White Water-Lily.*
Native: In rivers and pools. Rare. July.
I. Barston Pool,* in the Blythe, *Y.* and *B.;* In the Anker near Tamworth, *J. P. MS. note*, *B. G.*; formerly abundant in Blackroot Pool, Sutton Park; pool by Middleton Hall; Springfield, Temple Balsall;* Merivale Park.
II. In a pond at Ragley, *Purt.*, i., 251; River Avon, Wolston Mill, 1870, *H. W. T.*

NUPHAR.

N. lutea, *Sm.* *Yellow Water-Lily.*
Native: In rivers and pools. Locally common. July to August.
I. Lane from Nechells Green to Washwood Heath, *Ick. An.*, 1837; Middleton Park; River Tame at Aston, and other places in its course; in the Cole, near Coleshill; near Blythe Bridge, in ponds; Barston, &c.
II. Leam! and Avon! *Y. and B.;* Aston Cantlow; in the Avon, by Bidford bridge; pool near Astley Castle, &c.

(To be continued.)

THE ANCIENT INHABITANTS OF THE COTSWOLD HILLS.

BY HENRY BIRD, M.D.

Traces may be discovered of four distinct races of men, before the Romans, who have dwelt upon the Cotswold Hills:—1.—The small, long-headed men of the tump tumuli, doubled up, without a cist, and only very rude flint flakes are found in such burial places. A skull of

* Known to have been introduced in these localities; possibly in the others also.

this race was obtained from a skeleton in Cubberley, near Cheltenham; and another skull of the same race in Chalcombe parish, near Bath. 2.—The athletic, long-headed race of the round-stone tumuli, with central cist, containing one or many skeletons, as the tumulus on dry heath-field, Leckhampton, Foxcote, and the waste, near Cheltenham; flint flakes and split leg bones being the only things found in them. 3.—The long, heart-shaped barrows, containing the remains of a long-headed, small race of men, placed in chambers in the left side of the barrow. The right-hand chamber at Belas Knapp and Rodmarton did not contain human remains. If the barrow at Caithness is a true representation of the horned barrows, the long barrows of the Cotswolds cannot be arranged with it, for most of the chambered barrows on the Cotswolds are heart-shaped, with an altar or dolmen at the larger end, and often having a small cist of the larger preceding race at the small end. [See "Fergusson's Rude Stone Monuments."] The leaf flints of the long, heart-shaped barrows are beautiful microscopic representations of the Palæolithic river-bed flints; the dry wallings of some of the barrows are so well constructed that you cannot resist the inference that this race was raised far above savages. No metals have been discovered in the burial places of the above-named races. 4.—The round-stone tumuli, with *dressed* stone central cists, containing burnt bones, cinerary urns, and bronze. These races may have constructed Avebury, Stonehenge, and all the rude stone monuments, and Stanton Drew, although a much later date is given for these structures by Fergusson. The regularly constructed earthern tumuli of Wilts and Dorset also belong to this race.

The races who first opposed the Romans were civilised, acquainted with the use of metals, used chariots in war, and cultivated corn. [See "Cæsar's Commentaries."]

In the neighbourhood of the Cotswolds the most ancient names are Gaelic, next Cymric, then Roman, and lastly Saxon, &c. In the names of places or objects there are no traces of Iberian names.

Men living in caves is only an accident, wherever caves exist, as in mountain limestone districts as the Forest of Dean, Gower, and Wookey, a hollow in the limestone of the Mendip Hills, a Celtic word, or Welsh, meaning a cavern-house. Many caves in such localities, with short entrances, possess indications of human occupation. But the aboriginal races were not restricted to such localities, but spread generally over fertile and open spots as the Cotswolds, therefore it is not contrary to what might be expected that traces of the same races as the cave men are found on the Cotswolds where few caves exist.

The object of such structures at Avebury, Stonehenge, and Stanton Drew is still unascertained. They may be the sites of battles, sepulchres, and very modern erections, as suggested in Fergusson's work; or orreries, and places for Sabean worship. A person standing on the altar-stone, at Stonehenge, in the longest day, will find that the sun rises directly over the friar's nose; and another stone, from the same spot, indicates the rise of the sun on the shortest day of the year. A large stone at Stanton Drew, called Hautville, also called Hakime or Hakillscoit, indicates the rising sun also. Regarding the shape of the skulls of these races, the first small race presents the same character in form as the Eskimo of the present day.

The second race have long skulls, measuring more than 21in. in circumference; 15in. from the foramen magnum, over the head, to the root of the nose; and 11in. over the vertex from ear to ear. This measurement was made in 1860. The bones of the skulls also vary greatly in thickness. The above measurement would induce the examiner to class this race with the cave men. Although the bones of this race are found in long barrows, under certain conditions, they differ considerably from the skulls found in the chambers of the heart-shaped long barrow, which are also a long-headed race, very superior in form to the two preceding races, and differing but little from the present races. The thigh and arm bones represent a race of no great stature.

The average length of the trunk of the human body being about 2ft. 5in., a thigh bone measuring 18in., and the bones of the leg and foot being equal to that of the thigh in length, would give the height to be about 5ft. 5in., without estimating the soft parts. Upon this scale I have been in the habit of calculating the stature from the length of the thigh bones. The structure of these barrows and the character of the skulls represent a people far removed above savages.

The skulls of the round earth tumuli of Wilts, as shown to me by the late Dr. Thurnam, differed greatly from the skulls of the round tumuli of Gloucestershire and the long heart-shaped barrows, being short-headed skulls. In combination with the burials of this race you find, in that district, bronze, and the fact that cremation was then generally adopted.

To the two first races an unknown antiquity must be given, being in the state of savages. From the long barrows to the Roman period, two thousand years may be stated as a fair estimate, calculated upon the facts in Scripture and most ancient writers.

ON A NEST-BUILDING FISH.

THE STICKLEBACK *(GASTEROSTEUS.)*

BY SILVANUS WILKINS.

That a fish could build a nest has been very much doubted, and even now when believed the fact is supposed to be very rare. In truth it is common enough, and as it can be made familiar, so to say, at our own doors, I have thought the subject would not be out of place in a magazine published in Birmingham. The strange part is, that the entire work of preparing the nest, hatching out, fostering and rearing the young, is done by the MALE.

The whole process of fish nest-building, by, literally, the hundred, can always be seen from April to July, in the ponds about the "Black Country." The simplest appliances will serve. There is nothing difficult in setting about observing the method of it, either out of doors or in your own homes. Take the train, say—to Bilston—ask for the Theatre in the Willenhall Road, and from the back of it strike into any of the paths across the pit mounds, in a northerly direction, towards Portobello. Before going a thousand yards you will come upon several ponds of various sizes, almost any one of which will do if you go the right way to work.

There are, however, two or three near together, known as Edwards's Pools, or "pewls," as the lads there call them, that are very good. I mention these, being easily found by name, but there are many others in the hollows off the main paths that are even better for quiet observation.

On coming to a pool saunter very slowly, casting your glance into the water about two or three yards ahead of you, near the side, where the water may be from six to twelve inches deep. A very little practice will enable you to see a fish of a brightish green colour, quickly turn away from the shallow into deeper water, out of sight as you approach. This is the male stickleback of our ponds, and you may now know you have "spotted" a home or nest, though, for the moment, you don't see it. Having marked the place in your eye where the fish sank out of sight, advance slowly directly opposite to the spot, and sit down on the bank about a yard away from the water, and do not move. In a very short time—a few minutes at the most—you will see my gentleman fish rise from the deeps, end on towards you; a "green-eyed monster of jealousy" of most brilliantly metallic hues. This is the courtship dress with which he has during the preceding few weeks clothed himself. What change of food or chemistry of life must have gone on during this period to deposit on his coat so rich a change of colour, beating all Elkington's electro-work hollow or solid, is, I opine, yet a mystery.

You are now over the chosen spot where the fish has made up his mind to squat or pitch his tent. Continue to remain quite still and he ignores you, and resumes work according to the stage it has reached. They begin to select a spot according to the warmth of the spring weather, about April; and by June one may be found settled in almost every square yard along the shallows.

You will first notice that he does not roam at large, but moves about in a radius only of four or five feet. If in the early stage, he will be constantly returning with a piece of water-weed, an inch or so long, in his mouth, like a bird with material to its nest, until the nest is formed. When finished, it is about the size of half a walnut, only much less convex, and is disguised by the water-weed and particles of the soil placed about it. If the bottom of the pool is small gravel, ash, or such like, he places the same material about to hide it, or if of the nature of sand or mud, he sucks some of these up in his mouth and puffs them out, like a smoker, about the surface of the nest with the same purpose, and, perhaps, to weigh down the lighter materials.

Having placed something on the bank to indicate his whereabout, you may always be sure to find him there at work for a few weeks until he has reared to maturity the entire brood. I indicate the spot with two stones, or bits of tile, as marks, treading one into the path the same distance from the edge of the water that the nest is in the water, and another further off in a right line with it. The starting of the process goes on all through April, May, June, and I have seen it in July, so that by land-marking opposite several nests you may see all the several stages, of a dozen if you like, going on at the same time.

If the nest is finished and charged with eggs, you may readily find it on the bottom of the pool by noticing a small hole about the size of a pea, with the lines of the weed-structure all leading to a centre, giving it the appearance of a small sphincter, pursed up like a mouth in a pucker. and that he is frequently poised over this opening inclined head downwards in the attitude of a good diver just entering the water, vibrating his fins to move the water towards and into the nest. This action may also be seen, with a bull's-eye lantern, going on at night.

Each fish has his own home and family, and protects them against all the world—that is to say, his fish world. This can be shown by catching one and marking him with a small loop of bright-coloured floss silk as a signal, which you draw just "taut"—not tight—over the narrow part of the body, leaving a small pennon to trail out about a quarter of an inch or so beyond his tail, by which to identify him, and then carrying him in a vessel some fifty yards away to another part of the pool, when in a short time, according to the distance, you will find him, like a homer-pigeon, returned to his nest, having been chased and driven on, like a runaway dog by many of the others as he passed over or near their territory. You can often keep him in view the whole way back. On these occasions he rarely stays to fight much except to make passage.

As soon as the home is ready he waits near, trimming it with his snout, until a lady visitor of a sad green shade, but withal sublimely portly, approaches. Then his vivacity is increased. He shoots back, dodging round her, and gets her between himself and the nest, pushing and butting at her with his lip, down towards an opening he has left at the base of the nest, through which she glides into it. While there he seems in a quiver of delight, but presently he butts at the opening she enters by where her tail may be seen protruding, and startles her out, lightened, through generally the other side, where a similar opening appears to be left. This seems to be the whole of the lady's direct responsibilities and duties. I say seems so, but it is conceivable that if we could divine her ruminations she might possibly be claiming for her work that it was more vital and honourable than her mate's, and that his work was but the materialistic.

The two openings at the base he now proceeds to close with weeds and by dragging the fibres of the nest together, leaving only the small hole at the top open, over which he diligently works at the vibratory action. This is now varied frequently at intervals of a few minutes by his curving his body round about and over the nest, first in one direction then the reverse, suggesting the action of a cat pushing against one's legs when purring. The hatching is evidently helped by the sun striking into the shallow water, as I have noticed that the time is always retarded by a few days in chilly weather. I have never observed them building in water much over two feet deep. Sometimes they build very near the edge, and in very hot weather, as the pool lowers by evaporation the nests become exposed. The pertinacity then with which they will continue fanning as the water recedes, with their bodies half out of the water, just turning back for a time for breath as it were, is, I may say, painful to see.

A good strong nest contains about a teaspoonful—from 200 or so of eggs—each about the size of a mustard seed. By the time—about fourteen days in hot weather—they begin to hatch out, the flow of the water, caused by the fanning, seems to loosen the texture of the nest, and as the young emerge from the egg the anxiety of the mid-husband (I can't call him mid-wife) begins, and his watchfulness and attention to increase until it reminds one of a panting colley dog on the skirts of a flock of sheep keeping them together. As they escape from the shell, he sucks or gulps the shell into his mouth, as he does other waste materials, carries it a few inches and blows it out to float away.

The young fry at first keep well together, circling about in the opening of the nest, but as they grow stronger they venture into the water around, where they are liable to be snapped up by the full grown of their own kind who are passing near. Now it is amusing to watch the extra industry and affection with which the male nurse will dart after the vagrants. He cannot well carry them as a cat does a stray kitten by the back of the neck, but as one may float out and away he follows it and it disappears, having been simply sucked into his mouth. While wondering what has become of the straggler, you notice he turns about, advances to the opening, and puffs or projects it, head over tail, back into the nest, more deftly, indeed, than Zazel is projected out of the monster gun in her Aquarium. You see she is well matched here, and not even original. This goes on constantly until he can see that each one can poise or hold itself in the water.

It is comical to see one of the fishlings with half of the body out of its shell, sometimes the head only, sometimes the tail, making wobbling attempts at swimming, and sometimes head and tail out, but with the shell round the middle of the body, like "Johnny Stout" in the pantomime. This finer work may partly be seen in a pool by slipping a white shallow saucer, palette, or an oyster-shell or two white side up, on the ground, close to the edge of the nest, when the young fry will show out in dark streaks over it, like a shoal of notes of admiration, which certainly they are. Now you may test the bravery of the parent, for if you pass a stick down amongst the young he will not be forced away, but often will strike at it hard enough for the blow to be felt by the hand.

The work of the nest building can be watched very well in the pools, but for rearing the young more can be done and observed in the aquarium. A trial or two in rearing generally proves successful. I will assume that the aquarium is prepared in the usual way with balanced vegetation, &c. It should have a bed of neat gravel, and some bits of clinker or stone with a slight hollow in one piece, well placed to lay the nest in. The water should not be colder than that of the pool.

One way is to catch a gentleman fish about May and turn him into the aquarium. If he builds and prepares a nest you then introduce, one alone at a time to prevent jealousy, his lady-loves, some six or so, and wait the course of events; but the better plan I think is this. Watch a few nests in the pool until you find one strong and full, over which the hatching has just begun, shown by his ceasing the constructing work, and beginning at the vibratory motion or fanning. Have ready a net, made of fine brown or dark green silk, about a quarter inch mesh, (such as girls used to net their back hair in,) sewn round a ring of about nine inches diameter. Get a small worm (a blood worm is the best, found here in the mud of the ditches) for a bait, without hook, tied to the end of a line of fine silk fastened to a stick. Lower the worm gently over the nest. At first he may retreat, but will soon return and gorge it far enough into his throat for you to raise him out into your net, slipped under him held in your left hand. Turn him out quickly into a jar, as large a one as your false pride will allow you to carry. They appear less excited and alarmed in this than in a glass bottle, and a new one is best for fear of taint of acids or sweets. If you haven't a worm, and will work very slowly, you can generally move this kind of net towards him, pass it under him, and lift him out into your jar, but they will shy and keep backing away from a white muslin net. Catching with the sort of net I mention is best, as I am not quite certain that disgorging the worm may not give the fish a sore throat. Having got the parent, you then reach out to his nest and carefully pass your two fingers under it into the soil to which it is very slightly attached, and raise it up with the eggs as little disturbed as you can, placing it with some water in a shallow vessel—it carries best so. I used a cold-cream pot, well cleaned, about three inches wide and an inch deep, covering it with the lid or a skin, held by an elastic band, to carry the nest home in.

The aquarium should be placed where the water receives a fair amount of sun, but will not get too warm, and the nest should either be turned away from where it can be seen except by a side view—or, better still, from behind some kind of screen with a hole in it. Or you may colour one side of the aquarium with some opaque green colour, leaving a small space clear through which to watch him at work. This is almost necessary, for if they see they are overlooked, they, like some other animals, are apt to devour their own offspring, hatching them out merely to swallow them as tit-bits. Feeding him with a small worm every few days helps to check his voracity.

In placing the nest in position, arrange it to lie in the hollow of the clinker or stone, about the same depth at which you found it in the water, as much like its proper form as you can, keeping the eggs under the conferva-framework of the nest, as little exposed as possible. This, however, does not so much matter, as the bold fellow when you introduce him to the water, after swimming about for a time, as soon as he finds the dwelling with its future family, will set to work at once to put it in order. This is very interesting. To help him to do this, a little of the conferva from the same pool should be added for materials. We are told the name of this "genus" is Gasterosteus, meaning spine-belly, presumably, I suppose scientifically, because its spines are chiefly on its back.

All the fresh-water species described, some six, are to be found in this locality, but there is one I have not seen specially distinguished anywhere. This is a fellow nearly black, which certainly I would suggest ought, from his surroundings, to be called the "collier," or may be, the "white-eyed Kaffre."

I have limited the paper to a few practical notes, helping, I hope, to the history proper of this strange little fish. I shall be glad if it induces any unpractised naturalists to observe and picture more fully his wonderful gifts and display of moods, affections, and sentiments, so much like our own.

There are many pools here undisturbed for years by cattle foot or banking up that are very rich in other pond life, but the Mines Drainage Commissioners are rapidly altering the face of parts.

Max Müller, in his "Manners and Customs," describes the practice of the Basques, that in Biscay the women rise immediately after child-birth, while the husband goes to bed, taking the baby with him: and he mentions how Mr. Tylor, in his researches into the development of civilisation, seems to despair of the existence of any custom anywhere which cannot be matched somewhere else, and he asks, is this a natural custom? Well, certainly, we have it well matched here, and may say it is a custom entirely natural to some fish. If man is a microcosm of nature, the complete counterpart or prototype of the practice is certainly found in the Stickleback of our ponds.

If this mid-husbandry was the practice in the early history of mankind, as he states, and it be probable, as we sometimes hear, that mankind will revert, in the second childhood of the race, to like ways, there may be some comfort to the strong-minded of the other sex in the prospect that ultimately the males of the future must return to the duties of the nursery.

THE MINERALS OF THE MIDLANDS.

BY C. J. WOODWARD, B.SC.

Nottinghamshire was omitted from the list of Midland Counties in my previous paper, so I give at once a table compiled from Mr. Hall's book.

MINERALS OF NOTTINGHAMSHIRE.

Locality.	Alabaster.	Anhydrite.	Fullers-earth.	Gypsum.	Satin-spar.
Gotham (Beacon Hill)	H	...	...	H	...
Newark-on-Trent	H	H	...	H	H
Nottingham	...	...	H	...	...
,, Clifton	...	...	...	H	...
,, East Bridgeford ...	...	...	...	H	...

I have much pleasure in acknowledging the following communications:—

DERBYSHIRE.

Mr. W. F. Howard, Secretary of the Chesterfield and Derbyshire Institute, copy of a paper by Mr. A. H. Stokes, F.G.S., on the "Economic Geology of Derbyshire."

The Rev. J. Magens Mello, M.A., F.G.S., his list of Derbyshire minerals.

LEICESTERSHIRE.

Mr. W. S. Gresley, F.G.S., minerals used in the arts, also references to books.

Mr. James Plant, F.G.S., a list of minerals.

NORTHAMPTONSHIRE.

Mr. B. Thompson, F.C S., F.G.S., list of minerals; also enclosing a communication from Mr. S. Sharp, F.G.S., F.S.A.

NOTTINGHAMSHIRE.

Mr. J. N. Dufty, F.G.S., reference to a locality for gypsum.

Mr. A. T. Metcalf, F.G.S., reference to localities for gypsum.

OXFORDSHIRE.

Mr. Thomas Beesley, F.C.S., list of minerals occurring in the neighbourhood of Banbury.

SHROPSHIRE.

Dr. Callaway, M.A., F.G.S., list of minerals.

WARWICKSHIRE.

Mr. Wm. Andrews, reference to locality for yellow ochre.

Rev. P. B. Brodie, M.A., F.G.S., list of minerals.

Rev. J. R. Burton, promises help.

It will be well to defer an analysis of the information contained in these communications until next month, by which time I hope to receive further replies. I shall be glad of any information, however scanty, respecting the minerals of the Midland district.

Birmingham and Midland Institute,

April 25th, 1881.

MIDLAND UNION: MEETING AT CHELTENHAM.

The Cheltenham Natural Science Society are making arrangements for the next Annual Meeting of the Union, which will be held at Cheltenham, under the presidency of Dr. T. Wright, F.R.S., on the 16th and 17th of June next. The details of the programme are not quite complete, but will, we believe, include, besides the usual meetings, a Conversazione on the evening of the first day, and several Excursions on the second. These will be for Geologists, Botanists, and Archæologists, and will probably include visits to Leckhampton and Birdlip, Sudeley and Toddington, Chedworth and Bourton-on-the-Water. The Local Committee will be glad to have the assistance of the various Societies in the Union in making the Conversazione as interesting as possible. They are particularly desirous to have the aid of Microscopists. All who are willing to exhibit Microscopes, &c., on the occasion will oblige by communicating to the Hon. Secretary of the Local Committee, Colonel H. Basevi, Elm Lodge, Prestbury, Cheltenham. The Hon. Secretaries of the Union will have the pleasure of reporting to the next meeting of the Council that applications for admission to the Union have been received from the Oxfordshire Natural History Society, the Birmingham Microscopists' and Naturalists' Union, and the Nottingham Working Men's Naturalists' Society.

METEOROLOGY OF THE MIDLANDS.

THE WEATHER OF MARCH, 1881.

BY CLEMENT L. WRAGGE, F.R.G.S., F.M.S., ETC.

Abnormally low temperature, a rising barometer, and the formation of an anti-cyclonic crest embracing the Midlands marked the first days of the month. These conditions broke up on the 3rd on the approach of an Atlantic depression, bringing hail and snow at some stations, and the rainy period of the month, with a sudden rise in temperature as the wind veered southwards. A subsidiary disturbance came up early on the 7th, followed by more rain, fresh westerly gales; and hail, thunder and lightning in North Staffordshire on the 8th, as the entire system cleared off to N.E. The gales continued till the 10th, when a broad "wave" of high temperature swept over our districts, giving maximum values at most of the stations and a spell of more genial weather, pressure holding temporarily steady. During the third week Central England was influenced by the conditions attendant on a well-formed area of high pressure, having its centre S.W. of the Lizard; light airs and calms prevailed, temperature again ran high, the sky cleared, and the summer anti-cyclone seemed as though striving to develop itself. The barometer reached its maximum on the 17th; depressions followed on the 21st and 24th, accompanied and succeeded in each case by heavy snow squalls and a fall in temperature. A period of quiet closed the fourth week, and March eked out with clear skies, hard frosts, and piercing easterly breezes—bitter enough in moorland districts! The total duration of sunshine, as registered at Hodsock, and recorded on twenty-three days, was 108·2 hours. *Mean* temperature was fairly about the average, but vegetation generally was unusually backward. The extreme radiation values were (solar) 122·0, at Burton, on 25th, and (terrestrial) 12·0, at Ashby Magna, on 31st. The mean temperature of the soil at

STATION.	OBSERVER.	RAINFALL. Total for M. In.	Greatest fall in 24 hours. In.	Date.	No. of rainy d.	TEMPERATURE. Greatest ht. Deg.	Date.	Greatest cold Deg.	Date.
GLOUCESTERSHIRE.									
Stroud	S. J. Coley, Esq.	1·64	·53	6	6	58·0	11 & 13	24·0	27 & 29
Cheltenham	R. Tyrer, Esq., B.A., F.M.S.	1·54	·43	5	12	58·5	17	19·5	1 & 29
WILTSHIRE.									
Marlborough	Rev. T. A. Preston, M.A.	2·77	·64	4	14	61·0	16	22·3	1
SHROPSHIRE.									
Woolstaston	Rev. E. D. Carr	2·46	·69	5	16	59·5	17	23·0	30
Stokesay		2·17	·63	5	11	62·0	17	19·5	29
More Rectory, Bishop's Castle	Rev. A. S. Male	2·08	·40	5	17	56·0	6	18·0	1
Bishop's Castle	E. Griffiths, Esq	2·52	·48	5	14	61·0	16	20·0	1
Cardington	Rev. Wm. Elliot	2·02	·66	5	12				
Dowles, near Bewdley	J. M. Downing, Esq.	1·80	·52	6	10	50·0	17	10·0	28
HEREFORDSHIRE.									
Stoke Bliss	Rev. G. Alexander	1·86	·47	5	14	58·0	10	25·0	27
WORCESTERSHIRE.									
Orleton, Tenbury	T. H. Davis, Esq., F.M.S.	2·06	·57	5	14	62·8	17	20·5	29
West Malvern	A. H. Hartland, Esq.	2·29	·61	4	11	60·5	17	23·0	1
Evesham	T. J. Slatter, Esq., F.G.S.	1·21	·37	5	11	59·5	10	22·3	28
Pedmore	E. B. Marten, Esq.	1·94	·47	5	12	62·0	13	24·0	30
Stourbridge	Mr. I. Jefferies	1·72	·45	5	11	59·0	10	21·0	30
Dudley	Mr. C. Beale	1·96	8)·47	3	11	55·0	10	25·0	29 & 30
STAFFORDSHIRE.									
Dennis, Stourbridge	C. Webb, Esq.	1·69	·43	5	10	62·0	17	20·0	1
Kinver	Rev. W. H. Bolton	1·59	·46	5	12	58·0	10 & 11	[illegible]2·0	27
Walsall	N. E. Best, Esq.	2·42	·51	3	10	59·0	11	25·0	29 & 30
Lichfield	J. P. Roberts, Esq.	2·62	·62	4	13	64·0	18	21·0	28
Grammar School, Burton	C. U. Tripp, Esq., M.A.	2·32	·75	4	17	62·0	11 & 17	23·[illegible]	1 & 28
Weston-under-Lyziard	Hon. and Rev. J. Bridgeman	2·32	·58	5	13	58·0	17	21·0	1, 30, 31
Wrottesley	E. Simpson, Esq.	2·45	·58	5	11	57·3	10	19·6	1
Tean	Rev. G. T. Ryves, M.A.	2·56	·66	5	17	58·8	11	21·0	28
Heath House, near Cheadle	J. C. Philips, Esq., J.P.	3·31	·78	5	18	58·0	11	21·0	1
Oakamoor	Mr. E. E. Kettle	3·84	·84	5	18	58·0	16	16·5	1
Farley, near Cheadle	C. L. Wragge, Esq., F.M.S.	3·38	·84	5	18	57·4	16	20·2	1
Beacon Stoop, Weaver Hills	C. L. Wragge, Esq., F.M.S.	1·65	·73	5	16	53·8	16	20·8	1
Alstonfield	Rev. W. H. Purchas	4·65	1·18	5	14	58·1	16	15·5	25
WARWICKSHIRE.									
St. Mary's College, Oscott	J. MacElmail, Esq.	2·32	·62	5	13	60·1	17	21·8	1
Henley-in-Arden	T. H. G. Newton, Esq.	1·96	·52	5	14	60·5	11	18·0	1
Park Hill, Kenilworth	T. G. Hawley, Esq.	1·85	·56	5	12	60·0	11	23·2	1 (30
Coundon, Coventry	Lieut.-Col. Caldicott	2·21	·61	5	13	59·0	10	25·0	25, 27, 29,
Rugby School	Rev. T. N. Hutchinson	1·55	·45	4	11	64·0	11	22·6	1
DERBYSHIRE.									
Buxton	E. J. Sykes, Esq., F.R.A.S.	6·22	1·43	8	16	59·7	12	15·3	1
Stoney Middleton	Rev. U. Smith	3·87	1·00	5	15	53·0	7 & 11	20·0	1
Fernslope, Belper	F. J. Jackson, Esq.	3·39	·93	5	14	58·0	10	23·0	1
Linacre Reservoir	C. E. Jones, Esq.	3·71	1·12	5	14				
Duffield	W. Bland, Esq.	3·24	·81	6	12				
NOTTINGHAMSHIRE.									
Trent College	Rev. T. F. Fenns, M.A.	1·81	·76	4	11	64·0	6	21·0	27
Park Hill, Nottingham	H. F. Johnson, Esq.	2·[illegible]9	·66	5	13	57·4	11	24·2	1
Hodsock Priory, Worksop	H. Mellish, Esq., F.M.S.	2·56	·85	5	13	58·9	17	21·3	1
Tuxford	J. N. Dufty, Esq., F.G.S.	2·40	·84	5	12	55·0	11 & 18	25·0	1 & 29
LEICESTERSHIRE.									
Loughborough	W. Berridge, Esq., F.M.S.	1·74	·59	5	13	62·4	16	23·0	28
Syston	J. Hames, Esq.	1·07	·58	5	13	62·0	12	22·0	1
Leicester	H. Billson, Esq.	1·62	·36	5	11	60·5	11	21·8	1
Town Museum, Leicester	M. Browne, Esq., F.Z.S.	1·43	·45	5	13	59·7	11	22·8	1
Ashby Magna	Rev. Canon Willes	1·56	·55	5	11	58·0	11		
Waltham-le-Wold	E. Ball, Esq.	1·48	·49	5	11	52·0	5	23·0	21
Dalby Hall	G. Jones, Esq.	1·22	·56	5	13	62·0	11	18·0	31
Coston Rectory, Melton	Rev. A. M. Rendell	1·49	·46	5	13	58·8	16	15·0	1
NORTHAMPTONSHIRE.									
Towcester	J. Webb, Esq.	1·78	·49	5	10	64·0	7	23·0	27 & 28
Castle Ashby	R. G. Scriven, Esq.	2·00	·51	4 & 5	11	60·0	11	26·0	29
Kettering	J. Wallis, Esq.	2·10	·62	4	11	57·0	11, 12, 19	24·0	1
Althorp	C. S. Groom, Esq.	1·69	·43	5	10	58·0	10 & 11	20·0	27 & 28
RUTLAND.									
Northfields, Stamford	W. H. Hayes, Esq.	1·42	·45	5	9	54·0	9	23·0	28 & 29
Uppingham	Rev. G. H. Mullins, M.A.	1·42	·47	5	12	58·6	11	22·4	1
OUTPOST STATIONS.									
Spital Cemetery, Carlisle	I. Cartmell, Esq.	2·27	·62	10	11	57·8	8 & 13	15·8	2
Scarborough	F. Shaw, Esq., F.M.S.	2·94	·92	5	16	60·8	17	22·4	1
Blackpool (North Shore)	C. T. Ward, Esq., F.M.S.					49·7	6	26·5	31
,, (South Shore)	,, ,,	3·61	·71	13	18	49·7	7	23·8	30
Llandudno	J. Nicol, Esq., M.D., F.M.S.	2·13	·42	8	17	56·9	17	28·0	31
Carmarthen	G. J. Hearder, Esq., M.D.	4·13	·70	5 & 23	14	60·5	17	22·2	1
Altarnun, Cornwall	Rev. J. Power, M.A.	6·10	·99	24	17	56·0	19	19·0	1
Sidmouth	W. T. Radford, Esq., M.D.	3·56	·69	13	13	56·2	18	25·3	1
Ramsgate, St. Augustine's)	Rev. T. E. Egan, O.S.B.	1·70	·42	4	61	57·5	10	27·2	1

Caution *may* be necessary in accepting the Beacon Stoop rainfall and minimum. *Vide* note in last number.—C.L.W.

Farley, at 1 foot, was 38·6; at 2 feet, 39·0. At Scarborough, the mean sea temperature was 40·1, or 1·7° cooler than the average of the previous four years. Ozone generally very plentiful, excepting on 16th, throughout the month. A solar corona was observed at Cheltenham on the 16th, and an aurora at Buxton on the 17th. During the third week seven regions of disturbance were noted in the solar photosphere. Several lunar halos were observed.

NOTES BY OBSERVERS.—*More Rectory.*—Curlews here by the 16th. *Wrottesley.*—Scarlet fever very prevalent in this and adjoining parishes. *Alstonfield.*—Missel Thrush began to sing on 7th; Plovers returning on 9th, and Frogs croaking; first Wheatear seen on 29th. *Buxton.*—Flowering Currants bursting bud on 12th; Lilacs budding, 15th; Sycamore on 19th. *Waltham-le-Wold.*—Not a bud or leaf to be seen on the last of the month. *Uppingham.*—*Viola odorata* seen March 4th; *Mercurialis perennis*, 20th; *Ranunculus Ficaria*, 19th; *Veronica agrestis*, 19th; *Lamium purpureum*, 19th; (*Tussilago Farfara* plentiful 20th;) *Apis mellifica*, 9th; *Musca domestica*, 11th; Tortoiseshell Butterfly, 13th; Jackdaws building, 15th; Frog Spawn, 11th.

Correspondence.

EARLY FLOWERS.—During January and February two of our boys brought me the following specimens, all except those marked with an asterisk being still discoverable:—

*Brassica Rapa.
Capsella Bursa-pastoris.
Viola arvensis.
Cerastium triviale.
Stellaria media.
Arenaria serpyllifolia.
Ulex Europæus.
Alchemilla arvensis.
Sherardia arvensis.
Matricaria inodora.
Senecio vulgaris.
Bellis perennis.
Taraxacum Dens-leonis.
Veronica polita.
,, Buxbaumii.
,, arvensis.
,, serpyllifolia.
Lamium amplexicaule.
,, purpureum.
* ,, album.
Primula vulgaris.
Euphorbia Peplus.
Poa annua.
*Ranunculus repens.
Scandix Pecten.

These have all survived from last year. Of this year's plants they have found—

Chærophyllum sylvestre, Feb. 1st, (only two plants.)
Galanthus nivalis, Feb. 3rd.
Ranunculus Ficaria, Feb. 3rd, 10th, 25th.
Daphne Laureola, Feb. 5th.
Cardamine hirsuta, Feb. 5th, (only one plant.)
Corylus Avellana, Feb. 5th, (fertile.)
,, ,, Feb. 6th, (barren.)
Mercurialis perennis, Feb. 10th.
Valerianella olitoria, Feb. 19th.
Petasites vulgaris, Feb. 24th.
Tussilago Farfara, Feb. 26th.

T. A. PRESTON, Marlborough, March 3rd, 1881.

Scilla nutans in flower, April 18th; *Hirundo rustica*, first seen April 15th.—CHAS. F. THORNEWILL, Burton-on-Trent.

Botanical Notes from South Beds, with Specimens.—

Name.	Date.	Aspect.	Soil, Situation, &c.
Corylus Avellana........	Feb. 13th.	S.W.	Chalk. Coppice.
Mercurialis perennis	March 6th.	S.W.	Marsh spinney. First pistillate plants seen.
,, ,, ...	March 1st.		Staminate flowers not unfrequent.
Ranunculus Ficaria	March 6th.	W.	Warm bank, on sandy soil.
Draba verna............	March 8th.	open.	Road side, on sandy soil.
Caltha palustris	March 15th.	open.	Boggy meadow.*
Cardamine hirsuta	March 15th.	W.	Bank of rivluet.
Anemone nemorosa	March 18th.	S.W.	Coppice, on clay soil.
Potentilla Fragariastrum..	March 26th.	W.	Coppice, on chalky soil.
Petasites vulgaris	March 29th.	open.	Boggy meadow.*
Nepeta Glechoma	March 30th.	S.E.	Warm hedge bank, chalky soil.
Viola sylvatica..........	April 2nd.	S.W.	Warm hedge bank, chalky soil.
Fragaria vesca	,,	S.W.	Coppice, on chalky soil.

* On March 13th, 1880, in this meadow, Butter-bur, Marsh Marigold, and Pilewort were well out in blossom and much more advanced than at the end of March of this year.—J. S., Luton.

Flowering of Plants.—March 15th. *Potentilla Fragariastrum, Ranunculus Ficaria;* March 16th, *Bellis perennis, Tussilago Farfara;* April 7th, *Adoxa moschatellina*; April 11th, *Anemone nemorosa;* April 14th, *Viola canina, Glechoma hederacea, Luzula campestris;* April 17th, *Stellaria Holostea, Oxalis Acetosella.*—O. M. F., Frankton, Salop.

Autumn Flowering of Mercurialis perennis, &c.—On November 27th, 1873, a specimen of this plant was brought to me; on September 27th, 1878, my sister found one in flower, and others were found that year up to December 6th. Again, from October 17th to November 5th, 1879, specimens were gathered from time to time. I have been led to expect specimens every year, though last autumn none were found, so far as my experience goes. The remarkably warm December of last year brought *Ruscus aculeatus* into bloom. *Potentilla Fragariastrum* was in flower on November 29th, and *Veronica hederifolia* as early as October 6th. All three of them have continued in flower ever since.—T. A. Preston, Marlborough.

Glossary of Mining Terms.—I am preparing for the English Dialect Society a "Glossary of Mining Terms," and shall be much indebted to any one who will help me by sending lists of the terms now actually in use; or references to published works in which such terms are contained.—James Britten, Nat. Hist. Museum, South Kensington, S.W.

Dicranum montanum, new Warwickshire habitat.—On Saturday, April 16th, whilst searching in some of the woods near Coventry for Hepaticæ, I came across a fine growth of the rare moss, *Dicranum montanum.* This moss I first found, in 1870, in Sutton Park; it was then new to the British Flora, and for some little time the Sutton Park locality was the only known British station. Subsequently, Mr. E. M. Holmes, one of the most indefatigable of English Bryologists, found it in Abbey Wood, Kent, from whence he sent me nice specimens; more recently it has been found in the North of Scotland, in the East Highland province. Unfortunately, in 1871, the oak upon which this moss was abundant in Sutton Park was felled, and so my first station was destroyed; the same year, however, I found it sparingly on another oak near to the original station, and here I saw it, still growing sparingly, a few days since. It was a very pleasing sight to me to see quite an abundance of this rare plant in the Coventry wood, and as this wood is a strictly preserved one, the plant bids fair to be preserved also. I may mention that in habit this moss is not unlike *Weissia cirrhata*, growing in cushion-like tufts (always barren, however) on the roots of trees. *W. cirrhata* would be found higher up on the trunk or branches; this moss, evidently requiring more moisture, selects the roots. At first glance, it is very like *W. cirrhata*, but is softer to the touch, and has more strongly cirrhate leaves, when dry, than that moss. Under the microscope it is vastly different, having plane-margined leaves, strongly papillose, and toothed on the back of the nerve. I think it increases much like *Campylopus fragilis*, that is by the falling off of small leafy buds, as I noticed that these were abundantly scattered among some of the tufts I gathered.—J. E. BAGNALL.

Gleanings.

EARTHQUAKES.—As the process of geological mapping extends, it is found that earthquake disturbances occur almost exclusively along great faults or lines of dislocation of the strata.

NATIONAL MUSEUMS.—The new Natural History Museum, at South Kensington, was opened (in part) to the public on Easter Monday, April 18th. We hope shortly to describe it in a separate article.

IN THE PRESS.—As three forthcoming books of interest to our readers we may mention Mr. John Evans' "Bronze Implements, &c., of Great Britain;" Mr. J. E. Lee's "Note-book of an Amateur Geologist;" and Dr. Darwin's "Action of Earth-worms on the Soil."

A BIRD BOOK.—Dr. H. E. Dresser's great work on the "Birds of Europe" is now complete; it includes 5,000 pp. of letterpress and above 600 hand-coloured plates. It has been published by subscription, but a few copies are offered to the public at the price of fifty guineas each.

MARINE EXCURSION.—The Birmingham Natural History and Microscopical Society have appointed a committee to arrange for their Marine Excursion this summer to be made to Oban. The quiet sheltered sea in that neighbourhood offers excellent facilities for dredging operations, and some very interesting specimens may be looked for not frequently met with on other coasts, notably *Terebratula*, *Virgularia* and Corals. The magnificent scenery of the Kyles of Bute, the Pass of Glencoe, the Islands of Staffa, Iona, Skye, &c., will no doubt prove exceedingly attractive to the excursionists. The arrangements will be much the same as on the occasion of the excursion to Falmouth the year before last. Each member joining the excursion will contribute about £5 to a common fund to defray travelling and all incidental expenses. This sum will entitle him to a first-class railway ticket to and fro, and a seat in the steam yacht for dredging, or to a carriage ride daily if he prefers it. The hotel expenses will be on a tariff to be agreed upon, and will be defrayed by each member personally. The time fixed for the excursion will be about the first week in July, and the period of stay about ten days. Members of the Midland Union desirous of joining the excursion should send in their names without delay to Mr. John Morley, Hon. Sec., Sherborne Road, Balsall Heath, Birmingham.

EOZOON CANADENSE.—The controversy as to the organic nature of this, the oldest-known fossil, is not yet ended. Not long since an eminent German Professor (Möbius) gave an elaborate verdict against its animal origin, and now Profs. King and Rowney announce the early publication of their work on Rock Metamorphism, in which they will attempt to show that the (so-called) Eozoon is simply a result of metamorphic action simulating organic structure.

INCLUSIONS IN MINERALS.—In the "American Journal of Science," Mr. Hawes and Prof. Wright describe some remarkable specimens of smoky quartz from Branchville, in Connecticut. The quartz is so full of cavities containing condensed gas, that a report like the explosion of a percussion cap takes place when a fragment is knocked off with a small hammer; when heated, it decrepitates with such violence that bits fly whistling through the air to a distance of twenty feet. Analysis shows the contents of the cavities to be carbonic acid (in both the liquid and the gaseous states) water, and a trace of nitrogen.

Reports of Societies.

BIRMINGHAM NATURAL HISTORY AND MICROSCOPICAL SOCIETY.—GEOLOGICAL SECTION.—March 22nd. Mr. W. J. Harrison, F.G.S., exhibited and described a collection of Liassic fossils, giving a brief *resumé* of the life of the period. Mr. G. T. Cashmore exhibited, on behalf of Mr. C. J. Woodward, B.Sc., a quartz crystal, which had been treated with hydro-fluoric acid. Three of the faces were more acted on than the others, showing that there are three planes of symmetry, and not seven, as usually supposed. Mr. Cashmore also exhibited a piece of mountain limestone from North Derbyshire, having the appearance of a conglomerate. Mr. Wright Wilson placed under the microscope *Echinorynchus proteus*, from the intestine of the edible frog. Mr. Bolton showed *Syncoryne eximia*, nearly every polype of which had swallowed a zoea crab; and Mr. Greenway a specimen of *Cristatella Mucedo*, recently burst from the statoblast. Mr. Levick then re-opened a discussion which had been commenced at the previous meeting, on the nature of *Volvox Globator*. He asserts that it is not a hollow sphere, as generally supposed, but that the contents are solid enough to retain their spherical form after the green covering membrane has been removed. He exhibited some specimens under the microscope in proof of the theory; and an animated discussion on the subject followed.—March 29th. Mr. J. E. Bagnall exhibited some mosses from Sutton Park, and an abnormal state of *Polyporus fomentarius*, a fungus found on decaying wood in a Birmingham manufactory. Mr. W. B. Grove exhibited three fungi, from Sutton Park. Professor T. W. Bridge exhibited a photograph of the second specimen of Archæopteryx, which was found in the course of last year, at Solenhofen. The Professor then read a paper on the "Scope of a Provincial Museum," in which he developed his views as to the plan on which the Biological Museum at the Mason College is to be formed. In the first place, it must be a teaching museum. To take one group, for instance, that of birds, he would have a specimen of each order, concerning which he would collect all the available materials for showing its morphology, its distribution in time and space, and its embryology. All the objects relating to one type would be combined together, either in one or in adjacent cases; we ought not to find the skin in one part of the museum, the skeleton in another, and the allied fossil species in another. The geological department of the museum should be confined to a collection, stratigraphically arranged, illustrating the peculiar palæontological and petrological characters of the successive formations. But a complete provincial museum had another side. It should aim at representing the fauna and flora of the country, but primarily of the district in which it was situated. The living forms of our island are undergoing slow but continual modifications through the agencies of modern civilisation; of all these the museum should be a faithful record. Mr. Montagu Browne and Mr. Allport, while approving of these suggestions, advocated an increased display of exotic forms, so as to give the student some idea of the fauna and flora of other countries, which are so different from our own.—On April 5th, the adjourned annual meeting was held, to receive the address of the retiring president, Mr. Wm. Southall, F.L.S., who commenced by giving a concise but comprehensive sketch of the history of botany from the earliest times, especial reference being made to Dr. Erasmus Darwin and the eminent botanists, Ray and Withering, who lived in this district. Mr. Southall showed how slowly the science grew at first, and then proceeded to some of its more recent and rapid developments, including the fascinating study of the geographical distribution, the cross-fertilisation, and the movements of plants. In regard to the former he stated that some of the North European floras have the same power of colonisation which distinguishes the nations of that part of the world. The Scandinavian flora is found on the Alps, the Carpathians, the Caucasus, the Himalaya, and the mountains of New South Wales and Tasmania, though in constantly diminishing numbers. He instanced the arum and the crocus as exhibiting cross-fertilisation by the aid of insects, and the fir tree by the aid of the wind. He then referred to Darwin's recent observations on the circumnutation of the growing radicle of the seed, and the purpose fulfilled thereby of enabling the point to make its way along the path of least resistance in the soil in which it grew. The address contained some admirable observations on the study of botany, and many useful and suggestive hints to young students. At the conclusion of the address a unanimous vote of thanks was passed to the lecturer.—BIOLOGICAL SECTION.—April 12th. Mr. W. R. Hughes exhibited, on behalf of Mr. Councillor Sharp, a mass of gum copal from Zanzibar, in which an insect of the genus Coccinella was found entangled. Mr. J. E. Bagnall exhibited *Scleropodium cæspitosum*, also microscopical preparation of same, from near Tettenhall; *Pellia epiphylla*, *Jungermannia connivens*, (new to the county,) *Jungermannia bicuspidata*, all growing and in good fruit, from Sutton Park; also microscopical preparation of *Jungermannia connivens*. Mr. W. G. Blatch exhibited *Gyrophæna variegata* and *Scydmænus exilis*, two species of coleoptera, from Sutton Park, both rare and new to the district. Mr. J. W. Pickering exhibited *Stentor niger* from Wyre Forest. Mr. J. Morley exhibited *Chætophora elegans*. Mr. W. Southall exhibited a water-colour drawing by Miss Southall of *Ataccia cristata*, a remarkable plant now in flower at the Botanical Gardens. Mr. T. Bolton exhibited a Marine Polyzoon, *Triticella pedicellata*, showing the spermatozoa. Mr. Silvanus Wilkins read a paper on a "Nest-building Fish." (See page 106.) Mr. Hughes, Chairman of the Section, congratulated Mr. Wilkins upon his paper, which he said was evidently the work of a practical Naturalist. He further remarked that the curious physiological fact alluded to of the male Stickleback making and watching his nest was an admirable illustration of one of the laws of multiplication established by Mr. Herbert Spencer in his "Principles of Biology," that the cost of *genesis* is not measured alone by the number of young produced, but by the weight of nutriment abstracted to form the young, *plus* the weight consumed in caring for them, and that this weight may be diversely apportioned. Thus the cod produces about a million of small ova, by far the greater part of which perish or are destroyed, a few only reaching maturity, while the *Hippocampus* produces only a few relatively large ova, carried about by the male for a time in a curious caudal pouch. The remarkable fish, *Arius Boakeii*, only six or seven inches in length, produces about a dozen eggs as large as small marbles, which the male carries about in his mout huntil they are hatched. In all these cases the degrees of fertility are measured by the number of young able to take care of themselves so as to reach the adult state. Some observations bearing on the subject were made by the Chairman and other members, and the thanks of the meeting were given to Mr. Wilkins for his interesting paper. At the request of several of the members, Mr. Wilkins kindly offered to take part in an excursion on May 14th for the purpose of making a practical acquaintance with the subject.—April 19th. Mr. J. Levick delivered an amusing and instructive popular lecture on the "Marvels of Pond Life." Many strangers were present by invitation. The various classes of animal and vegetable life to be found in a pond were briefly alluded to, and some of the more remarkable forms described at greater length. The lecture was illustrated by some very beautiful photographs of the organisms referred to, exhibited by the oxy-hydrogen lantern.

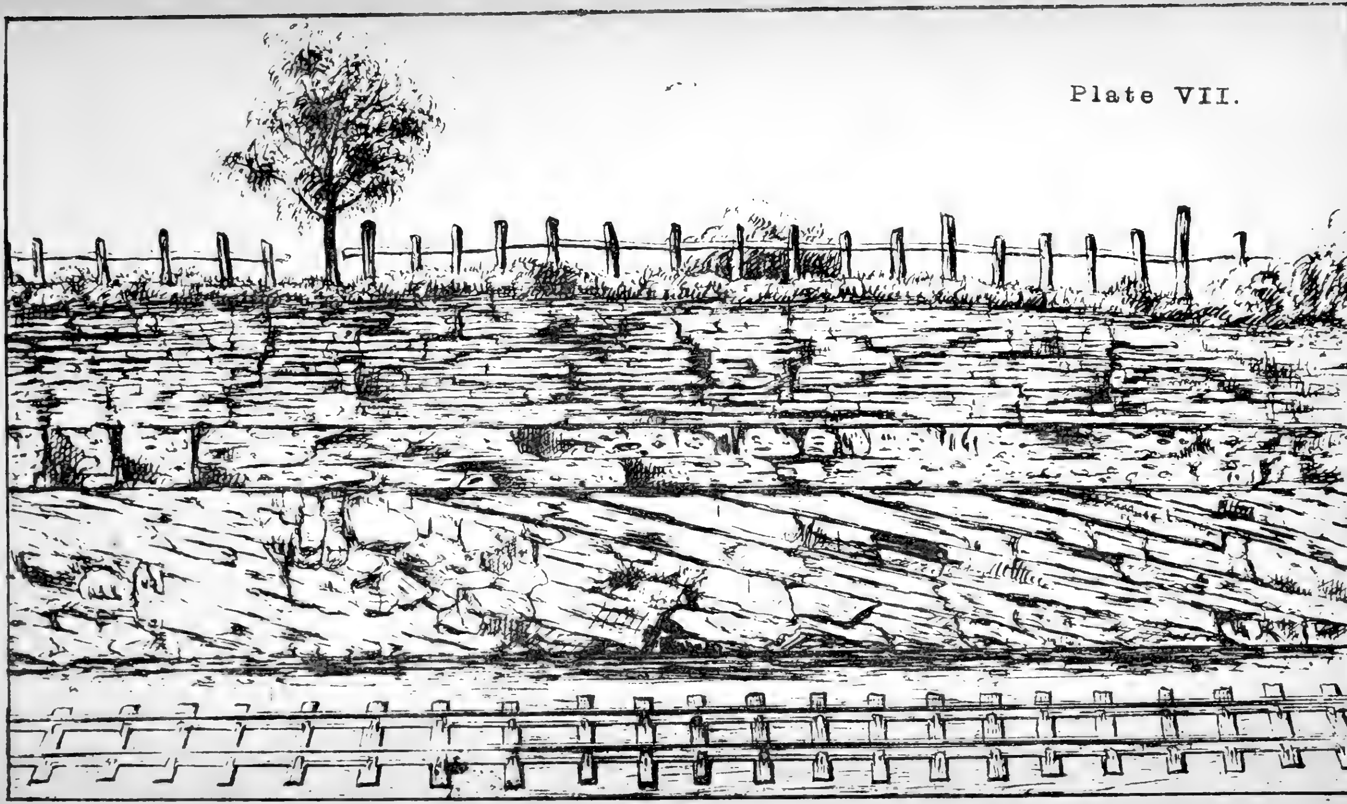
BIRMINGHAM AND MIDLAND INSTITUTE SCIENTIFIC SOCIETY. —April 15th. The members made an excursion to Coalbrookdale, and crossing the Severn passed over Benthall Edge to Much Wenlock, visiting the Abbey and Town Hall. The party then walked through Farley Dingle to Buildwas, tea being provided at the Bridge Inn, after which a stroll along the Severn bank was taken, over which a very charming view of the Abbey was obtained.

BIRMINGHAM MICROSCOPISTS' AND NATURALISTS' UNION.— March 7th.—MICROSCOPICAL AND GENERAL MEETING.—Mr. J. W. Neville exhibited shells of young oysters by polarised light; Mr. C. P. Neville various zoophytes; Mr. H. Boland specimens of *Helix cartusiana*, *Assiminia Grayana*, and *Planorbis lineatus;* Mr. H. Insly, Epidermis of Iris and Scarlet Pelargonium.—March 14th. A paper was read by Mr. Blay on "Common Poisonous Plants of the District." Specimens of *Nitella translucens*, showing circulation, were exhibited by Mr. Dunn, and *Epistylis* attached to *Cyclops quadricornis* by Mr. C. P. Neville.—March 18th. Excursion to Sutton Park.—March 21st. MICROSCOPICAL AND GENERAL MEETING.—Messrs. Boland and Madison exhibited *Limnœa peregra* from Keeper's Pool, Sutton Park, also the same from Keeper's well, which were found to be dwarfed and poor in texture compared with those from the pool. Mr. J. W. Neville showed a specimen of Batrachospermum, from Keeper's Pool; Mr. Betteridge, a stuffed specimen of Spotted Crake, *(Gallinula porzana,)* killed at Great Barr.—March 28th. This meeting was devoted to Microscopic Entomology. Mr. J. W. Neville exhibited hair of Anthrinus, and Caterpillar of Scolloped Oak Moth, mounted whole, showing tracheal system; Mr. C. P. Neville, larva of Dragon Fly *(Agrion)* and *Geophilus longicornis*, showing respiratory systems; Mr. H. Insly, head of Beetle, showing organs of mouth; Mr. J. Baxter, head of Common Gnat; Mr. Dunn, wing of ditto, showing scale arrangement; Mr. J. A. Grew, antennæ of Cockchafer; Mr. Darley, a Moth, twin spot quaker.

BANBURYSHIRE NATURAL HISTORY SOCIETY.—This Society held its first meeting on April 4th. There was an exhibition of objects from the neighbourhood, for the most part microscopic. A report on the meteorology of the district for the past three months was read by the President, and a note on the occurrence of *Meridion circulare*, by Mr. E. A. Walford. Mr. O. V. Aplin then read a paper, entitled "Ornithological Notes." After some little discussion upon Mr. Aplin's paper, Mr. S. Stutterd gave an address upon "Proposed Work for the Society," in which he advocated the collection and study of natural history specimens over small areas, and by storing such collections to gradually form the nucleus of a local museum. He spoke of the amount of work yet to be done in geological, zoological, and botanical fields, and pointed out how small a part of the local work had yet been attempted. For the next meeting, a botanical address was promised by the President, and the first field excursion was fixed for May 7th. The Society now numbers between sixty and seventy members.

PETERBOROUGH NATURAL HISTORY SOCIETY.—At the regular fortnightly meeting of this Society, held on March 22nd, a paper was read by Mr. E. Wheeler, one of the vice-presidents, on the subject of "Limestones." The special characteristics of the various kinds of limestone were described, but the paper dealt chiefly with the *formation* of limestones, the line of argument followed being that which has been brought forward by Dr. Carpenter and others, viz., that all limestones, whether fossiliferous or showing no traces of fossils, have been formed in the same way by the accumulation of the remains of small organisms. The paper was illustrated by a number of specimens. Mr. Gee presided, and there was a good attendance.

Plate VII.



Section at Kimberley Station, (Midland Railway,) showing Unconformability of Carboniferous and Permian Formations.

(a) Carboniferous—Middle Coal Measures. (b) Permian—Marl Slates with Breccia at Base.

THE PERMIAN FORMATION IN THE NORTH-EAST OF ENGLAND,

WITH SPECIAL REFERENCE TO THE PHYSICAL CONDITIONS UNDER WHICH THESE ROCKS WERE FORMED.

BY E. WILSON, F.G.S.

(Continued from page 101.)

Marl Slates (Kupfer Schiefer.)

The Marl Slates have long been known in Durham as a thin, but characteristic set of beds, coming at the base of the Magnesian Limestone, and also, though less commonly, in Yorkshire, but in neither of these counties have they been found to exceed a few feet, or at most yards, in thickness. During the past five or six years, I have been able not only to make out the presence of Marl Slates in Notts and Lincolnshire below the Magnesian Limestone, but also to show that beneath those counties they exist in, relatively speaking, considerable force, attaining a physical importance hitherto unknown in this country. In the North-east of England the Marl Slates occupy but a small surface extension; they are chiefly seen in the Magnesian Limestone escarpment, being there saved from denudation by the protecting cloak of limestone.

In *Durham* the Marl Slates consist of a series of thin-bedded grey limestones and shales. These beds are rarely more than a yard or so in thickness, but at one place (East Thickley) as much as thirty feet. They are sometimes entirely absent; the rapid fluctuations of these beds are evidently owing to their resting on an uneven floor of carboniferous rocks. They contain many imperfectly preserved plant remains, viz., *Neuropteris Huttoniana*, (King,) *Caulerpa* (?) *Selaginoides*, (Sternberg,) and *Polysyphonia* (?) *Sternbergiana*, (King,) and occasionally a few mollusca of the species *Nautilus Freieslebeni*, *Lingula Credneri*, *Discina Konincki*, and *Myalina Hausmanni*. The most interesting fossils, however, that have been found in these rocks, are the fishes of the genera Palæoniscus, Platysomus, Pygopterus, Cœlacanthus, and Acrolepis, the labyrinthodont amphibian *Lepidotosaurus Duffii*, and the lacertilian reptiles, *Proterosaurus Speneri* and *P. Huxleyi.*

In *Yorkshire* the Marl Slates seem hardly to have been noticed hitherto. This is, I believe, due rather to the scarcity of exposures of these beds and the want of diligent research than to their actual non-existence beneath the Magnesian Limestone escarpment. Mr. Kirkby, erroneously I think, paralleled the Lower Magnesian Limestone of South Yorkshire with the Marl Slates (and compact limestone) of Durham, and was of opinion that the Marl Slates had no special representative in Yorkshire. Mr. Lucas observes that "in the long interval between Leeds and Crakehall there are no sediments beneath the Magnesian Limestone, except here and there about five feet of flaggy and marly beds—the Marl Slates are not found in the interval. (*a*.) According to Sedgwick, however, they appear in the lower part of the terrace which extends from Kippax towards Aberford, east of Leeds, also north of Seacroft, in the quarries at Lindrick, near Ripon, and between Knaresborough and Ripon.* In the sandpits at Glass Houghton, near Pontefract, there may be seen intervening between the Lower Magnesian Limestone and the Quicksand, some fourteen or fifteen feet of thinly laminated and concretionary blue argillaceous limestone and shales, containing Schizodi and plant remains. Traces of these beds may also now be seen in the brickyard section at Conisborough already referred to. I am not at present aware of any other exposures of Marl Slates in Yorkshire, but have little doubt that such exist.

In *Notts* the Marl Slates consist of a variable series of thin and evenly-bedded grey or bluish fine grained argillaceous sandstones, occasionally ripple marked grey dolomitic (*b*) limestones, compact or oolitic, (*c*) and dark earthy shales. These beds contain numerous imperfect plant remains, (*d*) fragments of fossil wood, and thin seams of lignite, the casts of one or two species of mollusca, (axini,) annelid tracts, and a few fish scales. These blue rocks become yellow in surface exposures, and at greater depths along joints and bedding planes, (apparently owing to the conversion of ferrous carbonate into ferric hydrate in the presence of the oxygen of the air and of infiltrating waters.) At their base is a thin but very persistent band of breccia (*e*.) This bed varies from a compact grey sandstone to a coarsely brecciated conglomerate one to three or even eight to ten feet in thickness. It contains much angular coal measure débris—sandstone, ironstone, and ochreous shale—also rounded pebbles of white quartz and angular fragments of slate, chert, and limestone. In its coarser form it is a remarkably handsome rock, known to miners as "Plumcake" or "Mingled Rock." The Marl Slates and breccia rest with a pronounced unconformity on an eroded surface of coal measures, as may be seen in the railway cuttings at Kimberley, near Nottingham.

* There appears to be some doubt as to the identity of these beds in the latter localities.

(*a*) The Permian Beds of Yorkshire, by J. W. Lucas, F.G.S., Geol. Mag., vol. ix., p. 338.

(*b*) Microscopic sections of this rock show closely set oolitic grains, occupied by (yellowish colored) crystals of dolomite, imbedded in an earthy finely granular matrix. (See Fig. 4b, Plate ix.)

(*c*) The following is an analysis of this rock:—Carbonate of lime, 51·2; carbonate of magnesia, 38·6; oxide of iron, 1·7; clay, 5·8=97·3.

(*d*) Mr. Carruthers, who is kindly examining these fossils for me, says "they are very interesting, and disclose a flora known on the Continent, but of which only a very few imperfect materials have been detected in Britain."

(*e*) N.B.—This breccia belongs to the Marl Slate series. It is a mistake to separate it therefrom, under a distinct head, as Mr. Aveline does. (Geol. Survey Memoir on country round Nottingham, 2nd edit., 1880, p. 12.)

(See Plate VII.) This breccia is now known to cover an area of over 400 square miles beneath Notts and Lincolnshire, and is of some importance as enabling us to fix with certainty the base of the Permian rocks in underground mineral explorations. Sedgwick noticed these beds at Grives Wood, near Kirkby Woodhouse, and subsequently Mr. Aveline described them at that place as consisting of fifteen feet of blue shales and limestones with a thick band of breccia at their base. Mr. Aveline also noticed these beds in road cuttings, west of Hucknall Torkard, west of Skegby, and on Fulwood Top, near Sutton-in Ashfield, (*a*) and mentions the following fossils as having been found in this neighbourhood, viz., *Axinus Schlotheimi*, *A. truncatus*, *Bakevellia ceratophaga*, *Pleurophorus costatus*, and imperfect plant remains. Though familiar with these beds, neither Sedgwick nor Mr. Aveline appear to have suspected that they were the representatives of the Marl Slates of Durham. Since, however, these rocks have been so well displayed in the railway cuttings at Kimberley, (*b*) and proved in so many of the collieries of Notts, sunk through the Magnesian Limestone, as also in the boring for coal at South Scarle, Lincolnshire, always forming the basement member of the Permians, their true affinities with the Marl Slates of Durham have become apparent. The Marl Slates of Notts, while dying away on the south and west beneath the Magnesian Limestone, display a general tendency to thicken out on the east. On the south border and at several points along the western outcrop of Permians the Lower Magnesian Limestone conformably overlaps the Marl Slates, and rests directly on coal measures. At Newcastle, Cinderhill, and New Watnall collieries the Marl Slates are only from 10ft. to 25ft. thick. A little further east, at Hucknall Torkard, Bestwood, and Linby collieries, from 50ft. to 60ft. or 70ft. At Bolsover, on the Limestone Escarpment, 33ft., and at Clowne, near to same, 54ft.; but at Langwith Colliery, which lies two or three miles further east, 130ft. Again at Kiveton Station and North Anston, on the Manchester, Sheffield, and Lincolnshire Railway, the Lower Magnesian Limestone rests directly on red sandstones and grits of coal measure age, but three miles east, at Shireoaks and Steetley, no less that 100 feet of Marl Slates were found beneath the Magnesian Limestone.

At South Scarle, between Newark and Lincoln, twenty miles east of the Magnesian Limestone Escarpment, nearly 200ft. of these beds were passed through, (*c*) as will appear from the subjoined section :—

(*a*) Geological Survey Memoirs to maps 71 N.E., and 82 S.E.

(*b*) On the Permian Rocks of the N.E. of England, (at their south margin,) by E. Wilson, F.G.S., Q.J.G.S., vol. xxxii., p. 533.

(*c*) In a boring in search of coal, in 1873, and eventually abandoned without proving that mineral.

South Scarle (*a*.)

		Ft.	in.
	Alluvial (or Drift) Strata	21	0
Lias	Lower Lias Clay and Limestone, about	34	0
	Rhætic Beds, about	45	0
Trias	New Red Marl Keuper	614	0
	Lower Keuper Sandstone	252	0
	New Red Sandstone (Middle and Lower Bunter)	564	0
Permian	Upper Permian Marls	88	6
	Upper Magnesian Limestone	40	6
	Middle Permian Marls	141	0
	Lower Magnesian Limestone	26	0
	Marl Slates, dark Oolitic Dolomites, and grey Dolomitic Sandstones and Shales, containing axini (?) and plant remains, with Breccia 1ft. thick at base	193	0
Carboniferous	Coal Measures, (? Upper,) indurated Red Marls, with nodules of Ironstone	10	0
		2,030	0

(*To be continued.*)

THE FLORA OF WARWICKSHIRE.

AN ACCOUNT OF THE FLOWERING PLANTS AND FERNS OF THE COUNTY OF WARWICK.

BY JAMES E. BAGNALL.

(*Continued from page 104.*)

PAPAVERACEÆ.

PAPAVER.

[**P. somniferum,** *Linn.* *White Poppy.*

Occurs as a casual on waste heaps and in cornfields; in cornfields, Myton, *H. B.;* waste heaps in Wheyporridge Lane, Solihull; a mere waif from cultivation.]

P. Rhœas, *Linn.* *Field Poppy.*

Colonist: In cornfields, &c. Common. June, July.

Occurs all through the county.

Var. *b. strigosum*, Bœnn.

In cornfields. Rare.

II. Myton and Milverton, *H. B.*, *Exchange Club Report, 1877, page 13.*

P. dubium, *Linn.* *Long Smooth-headed Poppy.*

Colonist: On banks, waysides, and in cornfields, &c. Common. June to August.

Var. *a. Lamottei*, Bor.

Abundant all through the county.

Var. *b. Lecoqii*, Lamot.

Cornfields, &c., in Lias and marly soils. Rare.

(*a*) The tabulating of the rocks in the above section differs in several respects from that adopted by Professor Hull in his paper on the South Scarle boring, read before the Institute of Civil Engineers in 1877. (See Proc. Inst. Civil Engineers, Vol. xlix., part iii.) I may say that I have reconstructed this section, after the most careful examination of the cores, and a comparison of same with rock specimens of the formations to which I assign them. So far as the Permian Rocks are concerned, I vouch for the correctness of my section. Mr. Aveline, in the new edition of the "Survey Memoir of the Geology of the Country around Nottingham, (1880,)" seems to have ignored my paper on the South Scarle Section, (Q.J.G.S., vol. xxxv., p. 812,) and fallen into the same error that Professors Ramsay and Hull did, viz., of taking the Marl Slates of the Scarle section to belong to the Carboniferous formation Hence the necessity of this foot-note.

II. Kenilworth, Whitnash, *Y. and B.;* Cubbington, Burton Dassett, *H. B.;* Morton Morrell, Ashorn, *H. B.;* railway bank one mile from Shipston-on-Stour, Honington Hall grounds! *Newb.*

The characters by which this is distinguished are so slight that it may have been frequently overlooked.

P. Argemone, *Linn.* *Prickly-headed Poppy.*

Colonist: On dry banks and in cultivated fields. Locally common. June, July.

I. Sutton Park; Marston Green; Water Orton; Nuneaton, &c.

II. Claverdon, *Bree, Mag. Nat. Hist.*, iii., 165; Myton, *Y. and B.;* Rectory Garden, Shipston, and Tredington, *Newb.*; Wilmcote, &c.

[*Meconopsis Cambrica*, Vig., Welsh Poppy, occurs as a waif from cultivation. "Established on old walls, Warwick," *Herb. Perry;* on stone walls, near Rowington Hall, 1869.]

CHELIDONIUM.

C. majus, *Linn.* *Greater Celandine.*

Denizen: On banks, near villages. Locally common. June, July.

I. Marston Green; Sutton; Fillongley; Arley, &c.

II. Whitnash, Wootton, *Y. and B.;* Blackwell, and Honington, *Newb.;* Chadshunt, *Bolton King;* Stratford-on-Avon; Corley; Allesley; woods on Edge Hill, 1867.

FUMARIACEÆ.

CORYDALIS.

C. lutea, DC. *Yellow Fumitory.*

Alien: On old walls. Rare. May, June.

I. Abundant on churchyard wall, Maxtoke, introduced there from Allesley; old wall, Baker's Lane, near Knowle; on an old wall, Edgbaston Lane, *Ick. Anal.*, 1837.

II. On walls in Meilus Lane and St. Mary's Churchyard, Warwick, *Perry*; under a wall at Abbott's Salford! *Perry;* Kenilworth, *Y. and B.*; Tachbrook and Pinley, *H. B.*; on old garden wall at Tredington! and on walls of old kitchen garden, Honington! *Newb.;* old wall near Henley.in-Arden.

[*C. solida*, Sm., *solid bulbous Fumitory*, is recorded as occurring abundantly in the neighbourhood of Studley Castle, *Purt*, iii., 39.]

C. claviculata, DC. *Climbing Fumitory.*

Native: In woods and on banks. Rare. June to August.

I. On Gravelly Hill, near Erdington, *Perry Fl.*, p. 60; Sutton Park, in Lower Holly Hurst; Aston Lane, near Witton Lane, fairly abundant, 1876, now destroyed by building operations, 1880. I do not think the plant is native in Sutton woods, but it may be so in the other localities.

FUMARIA.

F. confusa, *Jord.* *Rampant Fumitory.*

Colonist: On wayside heaps. Rare. June, July.

II. On the roadside by a rubbish heap, beyond Bilton, (identified by the Rev. A. Bloxam;) *R.S.R., 1875.*

F. pallidiflora, *Jord.* *Pale-flowered Fumitory.*

Casual: On banks in marly soils. Rare. May, June.

II. Near Southam, and Coventry, *H.B.*

F. muralis, *Sonder.* *Wall Fumitory.*

Colonist: On banks and waste heaps. Rare.

I. Hedges in the Harborne Road, Edgbaston, abundant in 1872; waste heaps in the lane near Henfield, Knowle.

II. A weed in the Rectory ground, Harboro' Magna! *Rev. A. B.*; garden weed at Myton, *H.B.*

F. officinalis, *Linn.* *Common Fumitory.*
Colonist: On heaths and in fields. Common. May to July.
A variable weed, abundant all through the county.

CRUCIFERÆ.

RAPHANUS.

R. Raphanistrum, *Linn.* *Wild Radish.*
Colonist: In cornfields and cultivated ground. Local. June to August.
I. Walmley, *Rev. J. C.* In fields by Chelmsley Wood; Little Packington; Bannersley Rough.
II. Whitnash, *Y. and B.* Fern Hill! *H. B.* Honington, Willington, with yellow flowers, *Newb.* Stratford-on-Avon! *Cheshire.* Kenilworth.

SINAPIS.

S. arvensis, *Linn.* *Common Charlock,* *Catlick.*
Colonist: In cultivated ground and cornfields. Common. April to September. Very common throughout the county.

S. alba, *Linn* *White Mustard.*
Colonist: In cultivated ground. Rare. June?
II. Grafton, *Purt.*, i., 310. Stoneleigh, *T. Kirk.* Common in turnip fields, Bilton, *R.S.R.*

S. nigra, *Linn.* *Black Mustard.*
Native: Cultivated fields and waysides. Locally common. June to August.
II. In a field at Exall, near Rose Hall! *Purt.*, i., 310. Whitnash, *Y. and B.* Cawston, *H. W. T.* Great Alne, Binton, Billesley, Kenilworth, Bilton, (1880,) Spernal, &c. In the Lias districts of South Warwick this plant is as common as *S. arvensis* is in the sandy districts of North Warwick.

BRASSICA.

[**B. Napus**, *Linn.* *Wild Navew, Coleweed.*
Colonist: On banks and on the borders of fields. Distribution uncertain. May.
I. New railway banks, Sutton Park.
II. Arrow, *Purt.*, i., 314. Borders of fields, Kenilworth, *H. B.* Merely a casual of uncertain occurrence.]

[**B. Rutabaga**, *DC.* *Swede.*
Occurs as a casual in cultivated ground. Budbrook, *H. B.* Abundant in 1877, on the new railway banks, Sutton Park. June or July.]

B. Rapa, *Linn.* *Wild Turnip.*
Colonist: In cultivated ground, &c. Local. May and June.
Var. *a. sativa.*
I. Railway banks, Sutton Park; Marston Green; Wood near Bentley Park.
II. Railway banks near Warwick; Billesley.
Var. *b. sylvestris.*
II. By Fisher's Brook, near Warwick, and near Radford Semele, *H. B.*

DIPLOTAXIS.

D. tenuifolia, *DC.* *Wall Rocket.*
Denizen: On old walls and rubbish. Rare. June.
II. (*Sisymbrium tenuifolium*) Kinwarton, *Purt.*, i., 308.

D. muralis, *DC.* *Sand Rocket.*
Denizen: On old walls and sandy places. Rare. June to August.
II. Railway banks near Myton! *H. B.*; Whitnash, Harbury, old walls at Warwick! *H. B.*
Mr. Perry, who lived in Warwick, does not mention this plant.

SISYMBRIUM.

S. Sophia, *Linn.* *Flixweed.*
Native: On old walls and rubbish heaps. Rare. May, June.
I. In a brickyard, near Bedlam's End.
II. Studley Castle and at Donnington, *Purt.*, i., 306; Kenilworth Castle, *Cox*, *Herb. Perry*; in a brickyard, near Myton; railway, near Warwick, *H. B.*

S. officinale, *Scop.* *Hedge Mustard.*
Native: On banks, roadsides, &c. Common. May to September. Area general.

S. Alliaria, *Scop.* *Sauce alone, Garlick Mustard.*
Native: On roadsides and banks. Common. April to June. Area general.

ERYSIMUM.

E. Cheiranthoides, *Linn.* *Treacle Mustard.*
Colonist: In fields. Rare. June?
I. As a garden weed, Oscott College Grounds, *Rev. J. C.*
II. Kenilworth and Myton, *H. B.*; field in the Lawford Road, plentiful in an enclosure in the Newbold Road, *R.S.R.*, 1867. "38 Warwick, Mrs. Russell," *Top. Bot.*, p. 63.

HESPERIS.

[**H. matronalis**, *Linn.* *Dames' Violet.*
Alien or casual: On river banks, &c. Rare. May.
II. Canal bank at Emscote, *H. B.*; "in several places by the Stour from Tibbridge to below Tredington! quite naturalised;" "I have known it abundant for 30 years in many places on both sides of the Stour," *F. Townsend*, M.S. note, *Newb.*]

CHEIRANTHUS.

[**C. Cheiri**, *Linn.* *Wallflower.*
Alien: On old walls and ruins. Rare. April to June.
II. Walls at Warwick! *Perry*, *F. C.*, p. 56; walls of Stratford Church! *Cheshire*; Kenilworth! *Y. and B.*; Wroxall Abbey walls! *H. B.*; old walls at Tredington. *Newb.*]

CARDAMINE.

C. amara, *Linn.* *Bitter Cress.*
Native: In marshes and near pools. Locally abundant. May, June.
I. Middleton, *Ray. Cat.* 1672. Edgbaston Pond, *Freeman*, *Phyt.* i., 262; Coleshill, &c.
II. Harboro' Magna, *Rev. A. B.*; Kenilworth! Honily! *Y. and B.*; Allesley, *Bree*, *Mag. Nat. Hist.*, iii., 165; Holywell, Alcester, &c.

C. pratensis, *Linn.* *Ladies' Smock.*
Native: In moist meadows and on heathy waysides. Common. April, May. Common throughout the county.

C. hirsuta, *Linn.* *Hairy-leaved Ladies' Smock, Land Cress.*
Native: On old walls and waysides. Common. March to September. In all parts of the county.

C. sylvatica, *Link.*
Native: In ditches and drains, in woods, and by waysides. Common. May to July.

I. Sutton Park, Bentley Park, &c.

II. The rough at Alcester Mill, *Purt.;* Crockley Wood, *Y. and B.*; Allesley, &c. I find this in all our Warwickshire woods, and in many of our lanes. Very closely allied to the last mentioned species.

C. impatiens, *Linn.* *Impatient-podded Ladies' Smock.*

Native: In woods and cultivated grounds. Rare. May, June.

I. Hartshill Wood, *Rev. A. Bloxam, Phyt.*, iii., 324; Hartshill, July, 1843; *Mr. Townsend, Herb. Perry.*

II. Warwickshire, *Bree, N. B. G.;* Harboro' Magna, *Rev. A. B.;* garden weed, Bridge End, Warwick, *H. B.* "It has been found in the county of Warwick," *Syme, E. B.*, i., 162.

ARABIS.

A. thaliana, *Linn.* *Thale Cress.*

Native: On banks, walls, and in fields. Common. March to May. I have found this in every district in Warwickshire.

A. hirsuta, *Brown.* *Hairy Wall Cress.*

Native: On old walls. Rare. June.

II. Old walls at Allesley, *T. Kirk.* Stated to have been introduced by the late Rector, *Rev. W. T. Bree.*

A. perfoliata, *Lam.* *Smooth Tower Mustard.*

Native: On banks and waysides. Very rare. May, June.

I. Dosthill, near Middleton, *Ray Cat.*, 1762. Lane from the Castle Bromwich Road to Yardley, *Freeman, Phyt.*, i., 262. Marston Green, lane near railway station.

II. Lanes about Allesley, *Bree, Purt.*, iii., 369. Stoneleigh, Hollyberry End, *T. Kirk.*

BARBAREA.

B. vulgaris, *Brown.* *Winter Cress, Yellow Rocket.*

Native: On banks, in woods, and near ditches. Locally abundant. May to July. Area general, but often missing over wide districts.

Var. *b. divaricata.*

II. Morton Morrell, *Y. and B.* I think the plant I gathered at Honington, in the company of the Rev. W. W. Newbould, is this variety.

B. arcuata, *Reich.* *Yellow Rocket.*

Ambiguity: On banks and near ditches. Rare. June to July.

II. The Leam, near Leamington, 1864, *H.B. Herb. Brit. Mus.*;* Milverton, *H. B.;* Chesterton, *Dr. R. L. Baker, Exch. Club Report*, 1879, p. 5; Honington Park, pointed out by the Rev. W. W. Newbould.

B. stricta. *Anders.*

Casual (?): Cultivated fields. Rare. July.

II. Harboro' Magna, *Rev. A. B.*, 1876.

I should not have recorded this but for the authority of so excellent a botanist as the Rev. A. Bloxam; my own opinion would be that the specimen sent to me was a mere form of *B. vulgaris.* It was too fragmentary to decide positively.

B. intermedia, *Boreau.* *Intermediate Yellow Rocket.*

Colonist or Casual: Cultivated fields. Rare or overlooked. June.

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* Recently the Rev. W. W. Newbould has forwarded me many notes from the various herbaria in the British Museum; these will be distinguished by the abbreviations *Herb. Brit. Mus.* as above.

I. Cornfield near Packwood Church.
II. Cornfield near Kenilworth, *H.B.;* Rugby District, *R.S.R.*, 1874.

[**B. præcox**, *Br.* *Early Winter Cress, American Cress.*
Alien: Banks and cultivated ground. Locally rare. May to July.
I. Abundant on new railway embankment, Sutton Park, 1877—80.
II. Near Kenilworth and Coventry, on railway banks, *T. Kirk;* garden weed about Myton, *H.B.;* Rugby District, *R.S.R.*, 1874; Little Britain, near Wixford.
I do not think that this plant has any claim higher than that of a casual in Warwickshire.]

(To be continued.)

MIDLAND UNION OF NATURAL HISTORY SOCIETY MEETINGS.

CHELTENHAM MEETING, JUNE 16TH AND 17TH.

The Cheltenham Natural Science Society have planned no less than five different excursions for the meeting of the Midland Union, to be held on the 16th and 17th of June next. The Committee of Management, considering that no effort on their part should be wanting to enable Members of the Societies in the Union to explore the neighbourhood, determined on this course in preference to dividing, as heretofore, into two parties; ample time will be given to the Geologists, Botanists, and Archæologists of either party to follow their different pursuits; and by keeping numbers within bounds, it is hoped all will most thoroughly enjoy themselves, and return in the evening with a full appreciation of the beauties of the scenery. Arrangements will be made to repeat on the Saturday any of the excursions, should a sufficient number to form a party express the wish, but early application must be made to the hon. secretaries.

As many of the members who purpose to honour Cheltenham may be unacquainted with its neighbourhood and the various localities it is proposed to visit, a short description of each excursion may not be unacceptable, to enable intending visitors to select which party they prefer to join. Taking them in the order given in the programme:—

The first (which will be under the guidance of the President of the Union) will leave the Plough Hotel, and drive through the town to what is known as the Lower Windlass on Leckhampton Hill. The party will leave the carriages and ascend the hill, whence from a convenient spot the physiography of the Vale of Gloucester and the structure of the Cotswold Hills will be described, in a short paper, by Dr. T. Wright, F.R.S. The various beds of the Upper Lias and Lower Oolites exposed on the western slope will be pointed out. In the grounds of Major Barnard, where a quarry has lately been opened, in the tumbled Oolites can be found many casts of shells, sea urchins, bivalves, &c. Botanists will find *Herminium monorchis* near the top of the tramways, and all along the top of the hill, *Hippocrepis comosa*, *Echium vulgare*, *Orchis ustulata* and *pyramidalis*, *Ophrys apifera*, *Gymnadenia conopsea*, &c., &c. On rejoining the carriages, the party will proceed towards Birdlip. The road commands a fine view of the Vale of Gloucester. The various villages and homesteads present at each turn an ever-varying and most picturesque scene. Churchdown Hill and Church, Robin Hood's and Beacon Hill, from whence on a clear day the Bristol Channel is visible, are all in a view, which is bounded by the blue mountains of Malvern, and which relieves the flatness of parts, and gives a beautiful effect to the whole. The road passes by the Air Balloon and Crickley Hill, where there is a Roman Camp formed by a mound and ditch. At Birdlip, the party will rest. Through this village runs the old Roman road called the Ermine Street, Roman way from Cirencester to Gloucester. This consular way forms a very striking feature in the landscape. Archæologists may from here visit the Roman baths in Whitcombe Park, and can either rejoin the carriages at Tods Cottages, or proceed through the village of Whitcombe, along the Ermine Street Road, and await the arrival of the rest of the party at the Cross Roads, near "Horse by the Bridge," a distance of about three miles from Birdlip. Botanists can ramble in Cranham Woods, which, at this season of the year, are full of wild flowers, and mosses, lichens, &c., &c., and well worth examining. The party will drive home by the Vale of Gloucester Road, passing Cooper's Hill and the village of Shurdington.

The second excursion will leave Cheltenham and drive through the suburb of Charlton Kings, past Dowdeswell Wood, where can be found both kinds of the golden saxifrage—*Chrysosplenium oppositifolium* and *C. alternifolium*, *Lathræa squamaria* (Toothwort) and *Paris*. Then up the gorge by Sandywell Park, near which can be found *Geum rivale*, (water avens,) also the butterfly orchis; past Whittington Court and Church to Andoversford, then by a cross road by Owdeswell Farm to Withington; the brook called the river Colne crosses and recrosses the road. After leaving Withington the party will drive between Star Wood or Compton Wood and Chedworth Woods, a very pretty drive to the Roman Villa, one of the best preserved in England, and well worth a visit. The woods will repay the botanist, and such of the party as search for the "wonders of pond life" will have ample opportunity of exercising their perseverance in the River Colne. In this wood can be found the celebrated *Helix pomatia* or edible snail, the largest of its kind in England. A halt there will give plenty of time to explore the neighbourhood. Starting again the drive will be continued through the woods to Stowell Park, where the old manor house will be visited, (by permission of Mr. Thomas Walker.) It was built in the time of James I., on the site of an older mansion which belonged to the Tame family, and of which the Stowell branch was in Henry VIII.'s time represented by Sir Edward Tame. It passed into the Howe's, and in recent times was purchased by Sir William Scott, elder brother of Lord Eldon, who when raised to the Peerage in 1821 took his title from this place. After leaving Stowell the party will return home by the Pewsdown road, the views from which on either side are very lovely. In Cleevely Wood, which will be on the left close to the road, can found *Gagea lutea*, but it is out of flower at this season of the year.

The third party will leave Cheltenham by the Evesham Road to Bishop's Cleeve. The hills known as Cleeve Cloud and Nottingham Hill lay on the right. On both are the remains of old Roman camps. The view of these hills and of the Cotteswold range is very fine, but the road itself is uninteresting. On reaching Toddington Cross the road turns to the right, and goes straight towards the main range. We shall now have Bredon Hill, Oxenton Hill, and a Dumbleton Hill, all detached on our left, whilst we get a different view of those which were before on our right. On reaching Toddington the party will be shown over the Park and Grounds of Lord Sudeley (by permission.) The house is a good specimen of Sir Charles Barry's work, and the Park is well stocked with deer. Leaving Toddington, the party proceeds to Didbrook, and visits Hayles Wood and Abbey, founded 1246 A.D. In the former Botanists will find ample employment; and in the old ruins of the latter Archæologists much to interest them. The party next reach Winchcomb, and visit Sudeley Castle, with Mr. Dent's permission. These ruins are historical, and the old Chapel, built about 1660, has been beautifully restored, and contains very fine windows and the tomb of and a monument to Queen Katherine Parr, &c. The grounds are very tastefully laid out. From Winchcomb the party will return home over Cleeve Cloud. The road commands a magnificent view of the country and of the Malvern Hills, and the drive altogether will fully repay those members of the Union who may choose to select it. It is right to add that very much time cannot be devoted to botanising, as the distance to be traversed is very great. The party ought to find *Lathyrus Nissolia*, *Geranium pratense*, *Cichorium Intybus*, as well as some good roses.

The fourth party will drive to Deerhurst, where a priory existed in about the eighth century. The church, or parts of it, is supposed to be a veritable specimen of the architecture of the Anglo-Saxon period. After visiting the church, and having it explained, the drive will be through what is known as Queen Margaret's Camp to Tewkesbury. In a copse, on left bank of Severn, beyond Bloody Meadows, opposite to Lower Lode Inn, Botanists will find *Cynoglossum montanum* and *Thalictrum flavum* all along the river banks. At the Camp, the party will probably be met by the Rev. W. Symonds, F.G.S., of Pendock, who will explain the route of the armies. At Tewkesbury, the fine old Abbey will be visited, and an account of it given, after which the party will rest; driving on in the afternoon, visiting Pull Court and the moss-green shrubberies, where Botanists will find ample to repay them, and thence home.

The fifth party, under the guidance of Major Barnard, will be especially attractive to Botanists. Leaving the town at half-past nine P.M., and driving first to the Seven Springs or Wells, the source of the Thames, the neighbourhood, and Chalcombe Wood will be examined for botanical specimens, and, after allowing full time, the party will proceed to Cubberly, visit the church, then to Cowley, where Mr. Richardson Gardner's grounds and park will be thrown open; then, *via* Colesbourne, to Elkstone Church, the most unique specimen of Roman architecture in the kingdom, and alone well worth a visit. Over the Chancel is the unusual instance of a dovecote, and the walls are pierced for the access of the birds. In the neighbourhood can be found *Geranium lucidum*, *Cephalanthera grandiflora*, &c., &c. Leaving Elkstone, the party will, if time permit, proceed to Brimpsfield, and visit the site of the Old Roman Castle, otherwise it will go straight to Birdlip, where a long halt will be made, and a meat tea provided, after which, and giving ample time to botanise in Cranham Woods, the carriages will convey the party home by the same route by which the first excursion left Cheltenham. Those who love botanising, and are not too tired, are invited to leave the carriages at Crickley, and walk thence to Leckhampton with the conductor. To the mind of the writer, this will be a most enjoyable excursion, but members are recommended to take some refreshments along with them.

To Bryologists, the neighbourhood of Cheltenham is very attractive. Some eighty kinds of mosses are to be found, amongst which are *Phascum rectum* and *cuspidatum*, *Dicranum scoparium*, *Splachnum sphæricum*, and three of the Fissidentaceæ, and many others too numerous to occupy your pages with a mere list.

HENRY BASEVI, Hon. Sec. Chelt. Nat. Science Society.

THE NEW NATURAL HISTORY MUSEUM, SOUTH KENSINGTON.

BY GRENVILLE COLE,

Demonstrator in the Geological Laboratory, Royal School of Mines.

For years past frequenters of South Kensington, that ugly quarter in which the homes of science and of art are at last producing a noble variation, have viewed the steady progress of one of the largest London buildings, the new Natural History Museum; or rather, as it is barbarously and officially entitled, "The British Museum (Natural History.)" A front of 700 feet in length has stretched between Queen's Gate and Exhibition Road; towers have arisen that can be seen far away above the Chelsea roof-tops; great picturesque masses have loomed against the sunset, with the pinnacled massiveness of some old

German town; but it was not till the Easter of this year that the general public could be admitted to their latest treasure-house. The front may be briefly described as containing tiers of windows for a basement and three upper floors, the topmost being a series of gabled dormers, between which sit boldly-modelled Carnivora, statuesquely massive and erect. The east and west extremities are occupied by two grandly proportioned towers, which give in the interior an effective termination to the long galleries, except where, on the second floor, the lighting has been somewhat unfortunate. These are crowned by steeply-pitched slate roofs, as is the remainder of the front; and two smaller towers, terminating in lanterns lacking, perhaps, in dignity, flank the great entrance in the centre. The approach is by a curved and rising roadway, paved with red and grey granite between asphalt margins, and the effect as the deeply-moulded arch is reached, with its succession of Romanesque columns on either side of the divided doorway, the long front foreshortened to right and left, rich in ornament, yet never finical, is assuredly impressive, whatever one's opinion of the style. That Mr. Alfred Waterhouse has utilised for museum purposes so capable a style as Romanesque, which will give broad light by its arched windows and yet the requisite massiveness in its piers, will probably cause no regret; the only faults that may be discovered will be in the breaking of the front by horizontal lines of black—which perhaps might have been more sparingly employed—and in certain eccentricities of detail. Both without and within, the entire wall surface is constructed in terra-cotta blocks, giving a gentle warmth of colour and—let us hope—continued cleanness; while the material has afforded happy scope for the abundant ornament drawn from animal and vegetable life.

The great hall, intended to receive a type-collection, opens in almost cathedral-like proportions immediately from the stately entrance. At the north end, across the spacious tesselated floor, rise the steps tc galleries on either hand; while the vestibule portion is boldly spanned by a bridge springing from side to side, from whose centre a minor one at right angles leads upward to the second floor. The conception of this novel feature is masterly in itself, though probably more suited to an exterior than to what is in reality a room. The vestibule itself, where small monkeys appear in the decorations, has that welcome rarity, a groined roof; but the Typical Museum is suitably covered in with painted wood and glass, its ninety-six large panels and forty-eight smaller ones being adorned with decoratively-treated plants. These drawings, from sixty to seventy feet above our heads, are admirable examples of the care given to every portion of the building.

At the north end of the hall is a cross-shaped room for a purely British series of specimens, access being given by a door on each side of the steps; and the picturesque corridors, to which we may at once ascend, lighted on the one hand by tinted glass and on the other open, through triplet arches, to the ninety-feet width of hall, lead to the first floor galleries, the eastern one, that of Mineralogy, being already open. The whole west wing of the building cannot be filled for some time to come, owing to the expenses of transporting the Zoology from the old museum; but the Botanical collection, the conservatory-like fittings of which are already in their place on the second floor, may shortly be made available; while the Geological department has been brilliantly pushed forward and thrown open, as far as the Mammalia and Reptilia are concerned. We may add that the public are admitted free on every week-day, the hours throughout the summer being from ten A.M. to six P.M.

The Minerals are seen to full advantage in their gallery lighted from both sides, though at first the incongruity of the double row of terra-cotta piers and the bare wall-surfaces, as contrasted with the panelled and painted roof, produces a somewhat strange effect. The fossil fishes, fancifully strewn over the wave-lined slabs, might, moreover, have been confined to the lower floor; but the impression of the whole, especially the great arch at the entrance and at the passage to the end "pavilion," is undoubtedly one that grows. There is, under a circular bas-relief of the Dodo, a staircase that leads directly to the Palæontology beneath, though this doorway, if indeed intended for the public, is so closed that the doubtful visitor must traverse again the Mineral collection and twice the length of the Type Museum before he reaches the entrance to the loftier ground-floor room. Here, between a similar arrangement of rectangular piers and beneath a second tasteful roof, we recognise our old friends the Mastodon of Ohio, the Deinotherium skull of Eppelsheim, the Irish Elk, and, far away in the centre of the pavilion, the cast of the amiable Megatherium, all profiting grandly by the space and light around them. The Saurians have the benefit of a special gallery on the north, and opening from this at right angles run five rooms, also lighted from above, alternately wide and narrow, and each about 140 feet in length. These will eventually contain the lower fossils, from the fishes downward to the plants.

The basement, which is completely above ground, owing to the slope of the gardens from the Cromwell Road, contains laboratories and a variety of working-rooms, while each department possesses its special library, to be united, it is hoped, in time, as the nucleus of that general one so greatly needed.

Of course the back and sides of the building present the usual barrenness of uncompleted structures. How long will it be before another such front as that of the Cromwell Road hides these from view, and carries on the noble work? We have preferred to dwell upon that portion open to the public, though the kindness of Dr. Woodward has guided us through the whole east wing; but the work of removal will now be steadily proceeding, until the whole collections are spread out with an instructive breadth unattainable in the old Museum. Certainly a number of artisans and children will suffer from the removal of objects so easily appreciated ; but in regard to the East-end classes the change can make very little difference, while to the great borough of Chelsea, speaking purely from the popular point of view, the presence of a grand natural history collection, nobly mounted, cannot fail to prove a lasting influence.

Let us conclude by mentioning the admirable guide, issued for the sum of threepence, which has been drawn up by Mr. Bond, Dr. Woodward, Mr. Fletcher, and Mr. Carruthers. Its historical introduction, its detailed plans, its excellent *résumé* of the collections, will be found to explain and illustrate in full what we have glanced at in in this imperfect sketch.

METEOROLOGY OF THE MIDLANDS.

THE WEATHER OF APRIL, 1881.

BY CLEMENT L. WRAGGE, F.R.G.S., F.M.S., ETC.

As Mr. C. L. WRAGGE begins observing on Ben Nevis on June 1st inst., he earnestly requests that the observers for this magazine will kindly post their synopses to him *not later than the 6th* of the month, addressed, *Fort William, N.B.*, until further notice.

The barometer held remarkably steady until the 28th, the baric "curve" showing a singular contrast when examined with the charts for the previous months. Rainfall exceptionally slight. At Henley-in-Arden the fall was 1·589 less than the mean of eleven years, and the smallest fall registered there in April during that period. The low temperature (with strong easterly winds) prevailing till the 11th, and the spell of warmth thence to the 18th, followed by a dip below 32° Fah. on the 21st, 22nd, and 23rd, and a rise on the 24th to a closing mild period, are equally striking in the month's survey. At Orleton the average temperature was more than 3° below the mean of the last twenty years. Ozone in fair abundance. Duration of sunshine, reported from Hodsock, 140 hours. Extremes of radiation instruments: Solar, 124·7, 28th; terrestrial, 12·0, 21st, at Loughborough and Leicester respectively. Mean sea temperature at Scarborough 41·8. An Aurora was observed at Cheltenham on the 26th.

NOTES BY OBSERVERS.—*Cheltenham.*—The frosts of the 21st and 23rd greatly damaged the gooseberries; Horse Chestnut and Sycamore in good leaf by end of month. *Marlborough.*—Vegetation very backward throughout month. *Woolstaston.*—Cuckoo first heard 17th ; Sand-martin same day ; Swallows not seen till 30th. *More Rectory.*—Migratory birds unusually late, but Willow Wrens numerous after 16th. Cuckoo not arrived. *Bishop's Castle.*—Corncrake on 29th ; Swallow, 30th. *Cardington.*—Cuckoo, 26th ; Swallow, 27th. *Orleton.*—Chiff-chaff seen on 12th ; Swallow, 16th ; Cuckoo heard 21st ; Cherry and Damson trees in full blossom about 30th. No Thrush seen during last five months, and Blackbird become very scarce. *Wrottesley.*—Cuckoo heard 18th ; Swallow seen 17th. *Oakamoor (Churnet Valley.)*—Swallow first seen 9th. Said to have been seen at Alton 4th. *Farley.*—Cuckoo first heard 18th. *Alstonfield.*—First Swallow and Willow Wren, 16th ;

STATION.	OBSERVER.	RAINFALL. Total for M. In.	Greatest fall in 24 hours. In.	Date.	No. of rainy d.	TEMPERATURE. Greatest ht. Deg	Date.	Greatest cd. Deg	Date.
GLOUCESTERSHIRE.									
Stroud	S. J Coley, Esq	·52	·42	12	5	68·0	14	26·0	21
Cheltenham	R. Tyrer, Esq., B.A., F.M.S.	·87	·53	11	9	64·1	13	20·6	21
WILTSHIRE.									
Marlborough	Rev. T. A. Preston, M.A.	·87	·32	11	10	62·9	13	26·2	21
SHROPSHIRE.									
Woolstaston	Rev. E. D. Carr	1·12	·42	11	9	65·0	13	23·0	4
Stokesay		1·14	·53	11	10	63·2	13	25·2	23
More Rectory, Bishop's Castle	Rev. A. S. Male	1·03	·38	11	11	65·0	13	23·0	21
Bishop's Castle	E. Griffiths, Esq	1·20	·49	11	9	65 0	15 & 28	24·0	21
Cardington	Rev. Wm. Elliot	1·05	·48	11	9				
Dowles, near Bewdley	J. M. Downing, Esq.	·74	·42	12	4	56·0	25 & 30	17·0	21
HEREFORDSHIRE.									
Stoke Bliss	Rev. G. Alexander	·63	·36	11	7	62 0	13	27·0	3
WORCESTERSHIRE.									
Orleton, Tenbury	T. H. Davis, Esq., F.M.S.	·91	·59	11	8	66·2	28	24·2	21
West Malvern	A. H. Hartland, Esq.	1·09	·49	11	11	69·0	28	27·0	5
Evesham	T. J. Slatter, Esq., F.G.S.	·52	·32	11	8	66·5	13	21·8	4
Pedmore	E. B. Marten, Esq.	·93	·35	11	7	70·0	28	24·0	20
Stourbridge	Mr. I. Jefferies	·98	·42	11	7	65·0	13 & 28	25·0	21
Dudley	Mr. C. Beale	·77	·43	11	9	61·0	13	24·0	3
STAFFORDSHIRE.									
Dennis, Stourbridge	C. Webb, Esq	·75	·46	11	5	64·0	28	26·0	22
Kinver	Rev. W. H. Bolton	·85	·40	11	8	64·9	13	27·0	3 & 20
Walsall	N. E. Best, Esq.	·80	·36	11	10	59·0	13 & 14	25·0	3
Thorganby Villa, Wolverhampton	G. J. C. Broom, Esq.	·73	·51	11	8				
Lichfield	J. P. Roberts, Esq.	·71	·26	11	9	69 0	29	25·0	4
Grammar School, Burton	C. U. Tripp, Esq., M.A.	·75	·50	14	9	65·0	28	27·0	4 & 22
Weston-under-Lyziard	Hon. and Rev. J. Bridgeman	·89	·42	11	12	64·0	28	24·0	4
Wrottesley	E. Simpson, Esq.	·72	·43	11	7	61·0	14	23·7	4
Tean	Rev. G. T. Ryves, M.A.	1·31	·38	25	9	61·0	13 & 28	26·0	4 & 21
Heath House, near Cheadle	J. C. Philips, Esq., J.P.	1·12	·32	14	10	59·5	13	25·2	21
Oakamoor	Mr. E. E Kettle	1·27	·49	14	11	60·5	13 & 17	24·4	21
Park House, Farley	C. L. Wragge, Esq., F.M.S.	1·26	·51	14	11	59·5	13 & 17	25·9	21
Beacon Stoop, Weaver Hills	C. L. Wragge, Esq., F.M.S.	1·23	·72	15	9	55·0	29	22·5	7
Alstonfield	Rev. W. H. Purchas	1·86	1·18	14	9	62·9	13	20·0	21
WARWICKSHIRE.									
St. Mary's College, Oscott	R. Pate, Esq.	·67	·34	11	7	60·6	13 & 28	25·0	4
Henley-in-Arden	T. H. G. Newton, Esq.	·61	·35	11	8	66·0	17	23·0	22
Park Hill, Kenilworth	T. G. Hawley, Esq.	·74	·47	12	6	62·6	13	21·6	4
Coundon, Coventry	Lieut.-Col. R. Caldicott	·66	·50	11	7	64·0	14 & 30	24·0	3
Rugby School	Rev. T. N. Hutchinson	·41	·20	11	6	63·4	13	25·4	4
DERBYSHIRE.									
Stony Middleton	Rev. U. Smith	1·11	·20	30	7	60·0	15 & 16	25·0	3
Fernslope, Belper	F. J. Jackson, Esq.	1·20	·77	14	10	65·0	13	24·0	4
Linacre Reservoir	C. E. Jones, Esq.	1·23	·67	14	9				
Spondon	J. T. Barber, Esq.	1·43	·97	14	9	62·0		25·0	
Duffield	W. Bland, Esq.	1·52	1·02	14	7				
NOTTINGHAMSHIRE.									
Park Hill, Nottingham	H. F. Johnson, Esq.	1·05	·46	14	10	62·3	13	27·8	3
Hodsock Priory, Worksop	H. Mellish, Esq., F.M.S.	·70	·29	14	9	64·7	13	21·9	4
Tuxford	J. N. Dufty, Esq., F.G.S.	·80	·35	15	9	63·0	30	26·0	1
LEICESTERSHIRE.									
Loughborough	W. Berridge, Esq., F.M.S.	1·08	·71	14	8	64·3	13	25·6	4
Syston	J. Hames, Esq.	1·01	·62	14	6	67·0	14	25·0	4
Town Museum, Leicester	M. Browne, Esq., F.Z.S.	1·50	·85	14	11	69·3	17	24·0	4
Ashby Magna	Rev. Canon Willes	·79	·31	14	6	64·0	28	20·0	4 & 9
Kibworth	T. Macaulay, Esq.	1·49	·89	14	10	61·0	30	22·0	3
Waltham-le-Wold	E. Ball, Esq.	1·10	·69	14	7	62·0	11	25·0	3
Coston Rectory, Melton	Rev. A. M. Rendell	1·29	·65	14	12	62·8	13	26·5	4
NORTHAMPTONSHIRE.									
Towcester	J. Webb, Esq.	·66	·17	16	11	64·0	17 & 28	26·0	5
Castle Ashby	R. G. Scriven, Esq.	·80	·19	14	10	65·0	13	29·0	4
Kettering	J. Wallis, Esq.	1·34	·72	14	10	61·0	12, 13, 30	25·0	4
Althorp	C. S. Groom, Esq.	·71	·24	11	8	63·0	13	23·0	9
OXFORDSHIRE.									
Ratcliffe Observatory	E. J. Stone, Esq., M.A.	·68	·38	11	8	63·0	14	27·9	10
RUTLAND.									
Northfields, Stamford	W. H. Hayes, Esq.	·91	·31	13	10	63·0	11	23·0	4
Uppingham	Rev. G. H. Mullins, M.A.	·97	·50	14	11	62·4	17	24·5	4
OUTPOST STATIONS.									
Spital Cemetery, Carlisle	I. Cartmell, Esq.	·69	·20	21	10	64·6	14	18·7	4
Scarborough	F. Shaw, Esq., F.M.S.	·76	·20	11	13	60·8	29	31·3	3
Blackpool (North Shore)	C. T. Ward, Esq., F.M.S.					63·4	13	26·1	4
" (South Shore)	" "	1·16	·27	11	12	63·6	13	24·1	8
Llandudno	J. Nicol, Esq., M.D., F.M.S.	·94	·43	11	8	66·0	13	27·8	4
Carmarthen	G. J. Hearder, Esq., M.D.	2·72	1·15	13	12	63·1	17	25·1	4
Altarnun, Cornwall	Rev. J. Power, M.A.	1·46	·48	11	9	65·0	17	25·0	23
Sidmouth	W. T. Radford, Esq., M.D.	·90	·10	12	8	64·6	18	29·0	4
Ventnor	J. Codling, Esq.	1·15	·29	5	8	62·8	18	29·5	21
Ramsgate, (St. Augustine's)	Rev. T. E. Egan, O.S.B.	·82	·17	23	11	59·9	30	33·0	21

Cuckoo, 29th. *Spondon.*—No Swallows observed here, but a few White and about two Tortoiseshell Butterflies. *Nottingham.*—Cuckoo first heard 23rd. *Waltham-le-Wold.*—Not a bud on the hedges until the last week; Cuckoo and Swallow arrived on the 25th. *Oxford.*—Cuckoo heard 28th. *Uppingham.*—Wood Anemone, 3rd; *Potentilla Fragariastrum* and *Caltha palustris*, 5th; *Prunus spinosa*, 25th *Hirundo rustica*, 15th; *Cuculus canorus*, 29th. *Scarborough.*—Mean temperature, owing to persistent cold northerly and easterly breezes, nearly 3° below the average; vegetation in consequence made extremely little progress. *Llandudno.*—Frost each night but one till the 8th—very unusual for Llandudno; 115·6 hours of bright sunshine. *Ventnor.*—Oak and Ash in leaf last few days of month, but vegetation very backward in consequence of the cold.

Reviews.

Prehistoric Europe. By Jas. Geikie, LL.D., F.R.S. Pp. xviii. and 592; 13 woodcuts, 5 plates. Price 25s. London: Stanford.

This excellent book may be considered as supplementary to a well-known work, "The Great Ice Age," by the same author. In the latter book the various glacial deposits are described in detail, but in "Prehistoric Europe" Dr. Geikie gives a further and detailed account of the cave and river-accumulations, which he was the first to show are intercalated with boulder-clays, and consequently mark mild or "inter-glacial" periods; in these deposits we find Palæolithic implements—the earliest known evidences of the existence of man. Another and most interesting portion of this new book is taken up with the description of the recent and Post-glacial deposits—the raised beaches and submerged forests, the peat-bogs and river-gravels, to which due attention has only lately been paid by geologists. The migrations of animals and plants in consequence of the climatic changes, and the peopling of the British Isles with its present fauna and flora are most ably and intelligibly dealt with.

Dr. Geikie evinces an extensive acquaintance with, and gives full references to, a great number of papers by Continental geologists, and many of his foreign "brethren of the hammer" have given him personal aid and information. He is consequently able to present a great mass of recent and reliable statements with respect to the nature, range, and origin of Continental Glacial and Post-glacial beds, such as we have met with in no other book. Without doubt "Prehistoric Europe" deserves at once to take a high place as a standard work in geological literature.

W. J. H.

The Post-Tertiary Geology of Cornwall. By W. A. E. Ussher, F.G.S. 59 pp., woodcuts. Printed for private circulation.

This is a very interesting and valuable account by a member of the Geological Survey of the recent deposits of Cornwall. The gravels of Crousa Down and the sands and clays of St. Agnes are considered to be the oldest surface deposits in the country, and to be of pre-glacial age. There is no true boulder clay and no markings on the rocks to indicate the former presence of glaciers in this district; the gravels, stream-tin deposits, and the stony clay called "head" are the results of the melting of great snow-masses, and of a period of heavy rains corresponding to the later part of the "Glacial Period;" the submerged forests which fringe the coast are due to a post-glacial depression of the land. W. J. H.

Correspondence.

NOTES ON THE ARRIVAL OF THE MIGRATORY BIRDS TO THE MALVERNS.

March	29th.—Sylvia hypolaïs	..	Chaffinch.
April	4th.—Saxicola œnanthe	..	Wheatear.
,,	10th.—Curruca garrula ..	..	Lesser Whitethroat.
,,	12th.—Yunx torquilla ..	..	Wryneck.
,,	14th.—Curruca atricapilla	..	Blackcap.
,,	14th.—Sylvia sibilatrix ..	..	Wood Wren.
,,	15th.—Cuculus canorus ..	..	Cuckoo.
,,	17th.—Phœnicura ruticilla	..	Redstart.
,,	22nd.—Hirundo rustica ..	..	Swallow.
,,	13th.—Salicaria arundinacea	..	Reed Wren.
,,	13th.—Muscicapa grisola	..	Spotted Flycatcher.
,,	24th.—Hirundo urbica ..	..	House Martin.
,,	24th.—Turtur auritus ..	..	Turtle Dove.
,,	23rd.—Sylvia locustella ..	..	Grasshopper Warbler.
,,	29th.—Sylvia luscinia ..	..	Nightingale.
May	3rd.—Ortygometra crex	..	Landrail.
,,	8th.—Hirundo muraria	..	Swift.

Of the winter migrants, the Hawfinch (*Coccothraustes vulgaris*) was very common all around this neighbourhood.

OF LEPIDOPTERA: DIURNI.

April 10th.—P. Rapæ.	April 19th.—A. Cardamines.
,, 13th.—P. Napi.	,, 27th.—S. Ægeria.
,, 13th.—P. Brassicæ.	,, 30th.—T. Rubi.

GEOMETRÆ.

April 27th.—R. Cratægata.	April 14th.—A. Badiata.
,, 20th.—S. Illunaria.	,, 14th.—M. Fluctuata.
,, 22nd.—S. Illustraria.	,, 14th.—A. Derivata.
,, 22nd.—T. Crepuscularia.	

NOCTUÆ.

April 14th.—C. Ridens.	April 14th.—T. Gracilis.
,, 14th.—T. Gothica.	,, 14th.—T. Stabilis.
,, 14th.—T. Munda.	,, 14th.—T. Instabilis.
,, 14th.—T. Rubricosa.	,, 14th.—T. Cruda.

W. EDWARDS, Great Malvern.

LEAFING OF OAK AND ASH.—May 15th—Parts of oak tree in gully open to S., near Farley, in young leaf. 16th—Ash coming into young leaf, leaves not fully expanded; situation, edge of wood, left watershed of the Churnet; open to N.E., and about 140 feet above the bed of the valley, and a quarter of a mile from the oak above mentioned.—C. L. WRAGGE.

Double Anemone nemorosa.—Several specimens (one of which I enclose) of this flower were found by Rev. C. Jarvis with a second row of petals. They grew by the roadside together with the usual form, but none of them were so large. I also send a primrose, gathered from a plant transplanted a year or two ago from a wood to the garden. There are double the usual number of petals and sepals, and two pistils.—A. E. I., Wragby.

Flowering of Plants.—*Cardamine pratensis*, in Derbyshire, April 30th, and in Shropshire, May 6th; *Ranunculus auricomus*, in Derbyshire, April 30th; *Silene diurna*, in Derbyshire, May 3rd, and in Shropshire, May 6th; *Erysimum Alliaria*, *Vicia sepium*, *Galium cruciatum*, and *Fragaria vesca*, in Shropshire, May 6th; *Orchis mascula*, *Ajuga reptans*, *Lamium album*, *Chærophyllum sylvestre*, in Shropshire, May 7th; *Ranunculus acris*, and *Lamium Galeobdolon*, in Shropshire, May 10th; *Scilla nutans* in Shropshire, May 12th; *Asperula odorata*, in Shropshire, May 15th.—O. M. F., Frankton.

Notes on Birds.—Arrival of summer migrants first noticed in 1881:—Chiffchaff, April 8th. In 1869 I heard one on March 9th; the general time is about March 20th to 30th. Willow Wren, April 13th. Swallow, April 13th. Tree Pipit, April 14th; generally arrives about the 20th. Blackcap Warbler, April 20th. Sedge Warbler, April 23rd. Yellow Wagtail, April 23rd; very late, often noticed in March. Swift, May 1st. Cuckoo, May 1st. Wood-wren, May 3rd. Landrail, May 5th; generally heard by May 1st, rather numerous this year. Fly-catcher, May 11th. Nightingale, May 1st. We rarely have this bird. The one this year has taken up its abode in a very small shrubbery between the River Trent and the high road where it sings, especially by night, apparently taking little notice of, or but little alarmed at, the constant traffic. It is one of the best singers I have ever heard. It has now been here a fortnight, from which I should fancy it will breed here. There is an echo very distinctly heard in some neighbouring buildings. (Morris alludes in his account of the Nightingale, to the fact that the bird is said often to choose situations for singing where this effect is produced.) I heard the echo before I read the statement, which is interesting. The last two nights being very cold, it has not sung much. Warblers are very numerous this year, but Starlings, Thrushes, Titmice, Finches, Golden Crests, and Kingfishers seem much less common than on previous years.—H. G. Tomlinson, The Woodlands, Burton-on-Trent.

On the Occurrence of the Cornish Chough in the Neighbourhood of Banbury, Oxon.—On the 8th of April last, our village bird-stuffer called me in to see a rare bird which he had just received, and which was unknown to him. I found a nice specimen of the Chough, *Pyrrhocorax graculus* (Linn.) It appeared to be immature, the legs being reddish orange and the bill yellow—the latter seemed to be unusually short. On dissection, I found it to be a female. The ovary contained a large number of rudimentary eggs, some of which were about the size of a mustard seed. In the stomach, which was very hard and strong, I found the remains of several small beetles and one caterpillar, entire, about an inch long. From the fact of the bird being in very good condition, and the stomach being well stored, I should say it had been in the neighbourhood for some little time. It was killed in Broughton Park, probably on the same day that I saw it. Of course, it is to be regretted that rare birds should be killed in the breeding season, but in this case the bird is so little likely to have nested anywhere in the neighbourhood that the capture may be deemed excusable. This is, I believe, the first occurrence of the bird in the district, and I have no record of its having been obtained in Oxfordshire.—OLIVER V. APLIN, Bodicote, Oxon, May, 1881.

A BOULDER.—In sinking a well at this village the men have brought up with the blue clay a boulder of about 6cwt., ice-polished on one surface, and very distinctly marked with striæ, showing glacier action. The stone is very hard and seems to be oolitic (limestone.) I shall have the stone placed in my garden, as, although many small boulders occur here, I have seen none marked like this one.—A. M. RENDELL, Coston Rectory, Melton Mowbray.

FLINT IMPLEMENTS.—Whilst staying a few days in January last with my brother, the Rev. R. H. Hart, Vicar of Hunston, about eight miles south of Lincoln, I availed myself of the opportunity to examine the sections now being made by the construction of the new line of railway from Sleaford to Lincoln; and coming upon some *old river gravel*, which the men were getting to grind up with lime, I was struck by its appearance, and the reasonable probability of finding flint implements amongst it. I had not examined it long before finding three flint chips, (a sketch of which, natural size, I forward,) perfectly sharp and unworn. I found them about five feet from the surface, the gravel being covered with about eighteen inches of peaty soil. This was about ninety yards due north of the beck and twenty from the road, where crossed by a railway bridge. I may add that the chips have been examined by Professor W. Boyd Dawkins, who pronounces them genuine. I hear that the gravel has since been covered.—THOMAS HART, Blackburn.

Gleanings.

PIGMY ELEPHANTS.—Bones of three small species of elephants have long been known to occur in the caves and rock-crevices of Malta and Sicily; the smallest of these (*Elephas Falconeri*) did not exceed 2ft. 6in. in height; another (*E. melitensis*) averaged 4 feet in height to the shoulder, and a third may have been 7 feet high. The occurrence of numerous bones of these extinct elephants in Malta proves a former connection of that island with Italy on the one hand, and with Africa on the other; a submarine ridge is in fact known to exist at this point by which the Mediterranean is divided into two deep basins, lying east and west of Malta respectively.

THE GEOLOGICAL SURVEY.—At the School of Mines' dinner on Dec. 17, Professor Ramsay, the Director-General of the Survey, announced that the Geological Survey of Ireland would probably be finished in 10 or 12 years; in England all the map work might be done in 4 or 5 years, unless they were then ordered to make a map of the superficial deposits, which would be of great value to agriculture, and would necessitate the re-survey of a large part of England.

THE TRIAS.—At a recent meeting of the Geological Society, Mr. C. E. De Rance (of the Geological Survey) remarked that the Keuper Beds below the Red Marls were now divided into the Waterstones, soft current-bedded sandstones called Frodsham Beds, which denoted entirely different physical conditions, and contained the millet-seed grains, and then the Lower Keuper Building Stone (*Labyrinthodon*

Beds.) Then came a line of erosion. In the Bunter Series were the Upper Mottled Sandstone, (with the millet-seed grains,) then the Pebble Beds, which had a different kind of current-bedding from that of the Frodsham Beds, then another line of erosion and the Lower Mottled Sandstone, with millet-seed grains again. The bedding of the sand-hills of Lancashire much resembled that of the Frodsham and other millet-seed beds in their high angle and rapid change.

A Nest-building Fish (p. 111.)—An extremely interesting Natural History exhibit has recently been on view in the room of the Birmingham Natural History and Microscopical Society, at Mason's College, during the past month. By way of practical instruction in rearing the young of the stickleback, Mr. Wilkins, assisted by Mr. Bolton, placed a fish and nest, obtained at Bilston, in a small aquarium, about fifteen inches in diameter, and the members of the society have had the opportunity daily of watching the hatching out of not less than 400 fry in a most healthy condition. The parent throughout, defiant of observation, has been tame and apparently unconcerned. The young have now disappeared, apparently having been eaten by the cannibal father.

Drawings of Living Organisms.—Part 5 of Mr. Bolton's portfolio of drawings and descriptions of living organisms, (animal and vegetable,) illustrative of freshwater and marine life, which have been sent out by him from his studio, 57, Newhall Street, Birmingham, with the living specimens, has just been issued, price one shilling.

Reports.

BIRMINGHAM NATURAL HISTORY AND MICROSCOPICAL SOCIETY.—Geological Section, April 26th.—Mr. A. H. Atkins exhibited *Orthis Budleighensis*, from a Bunter Pebble Bed at Kinver Edge. The Rev. P. B. Brodie, M.A., F.G.S., gave a lecture on "The Lias, with especial reference to Warwickshire." He described the country from Shuckburgh Hill to Lawford, between which places all the Lias zones crop out with their peculiar fossils. The best sections are at Harbury, Rugby, Stockton, Binton, and Wilmcote. The lecturer also described the life of the period, and referred to the exceptional position of Birmingham in not having a Museum of Natural History.—Biological Section, May 10th.—Mr. J. E. Bagnall exhibited *Salix cinerea*, showing the passage of stamens into carpels, *Prunus insititia* (Bullace) and *Prunus avium*, (Wild Cherry,) all from near Solihull. Mr. E. W. Badger exhibited a Primrose, in which all the parts of the flower were doubled. Mr. Harvey Collett exhibited *Distoma hepaticum* or *Fasciola hepaticum*, (Fluke,) from liver of Ox. Mr. A. W. Wills read a paper on "Some New Species of Desmidieæ" from North Wales, in which he described three forms new to science, viz.: *Cosmarium cambricum*, *Cosmarium coronatum*, and *Staurastrum anatinum*, specimens of which were exhibited under the microscopes. He also called attention to two other rare species found in a gathering from Mr. Levick's pond, *Closterium obtusum*, hitherto recorded only in Ireland, and *Closterium pronum*, which is added for the first time to the British flora. He also exhibited a variety of *Micrasterias denticulata*, which he proposed to call *M. denticulata*, var. *licmoides*. He then gave some practical directions as to the best manner of studying and identifying these beautiful plants, and explained a very ingenious method which he had adopted for facilitating the identification of doubtful species, by making drawings to scale of every form met with and attaching the drawings to small cards of a uniform size, which are then to be arranged in groups having the greatest similarity, numbered in rotation, so that on finding an unknown species it could be at once referred to the group which it most resembled and placed next to the individual in that group to which it approached nearest in form. If the number in this form is 50, then the new form should be numbered 50a, and so on. A large number of drawings arranged in this manner from Mr. Wills' own gathering, and from various other sources, were exhibited and examined with much interest by the members present, and the paper was listened to throughout with great attention. —On May 14th a highly successful excursion was made to Bilston, where the members of the party had an excellent opportunity of observing the nests of the Stickleback *in situ*, under the guidance of Mr. Silvanus Wilkins.—MICROSCOPICAL GENERAL MEETING, May 17th.—Mr. R. M. Lloyd read a paper on "Freshwater Aquaria," which will be printed in full in this magazine.—GEOLOGICAL SECTION, May 24th.—Mr. J. Levick exhibited two rotifers, *Notommata Brachionus* and *Peridinium tabulatum*, under the microscope. Mr. Southall exhibited *Equisetum Telmateia*, var. *frutescens*, and *Tremella clavariæformis*, a fungus growing on *Juniperus Sabina*. Mr. W. H. Wilkinson laid on the table a collection of plants gathered at Church Stretton, including *Lastrea filix-mas*, var. *Borreri*, *Lastrea montana*, *Cotyledon Umbilicus*, and *Viola lutea*. Mr. W. J. Harrison exhibited, on behalf of Mr. C. J. Rodgers, a remarkable specimen of flexible sandstone from India. The Rev. H. W. Crosskey, F.G.S., then gave an interesting lecture on "The Geology of the Glacial Epoch." He gave first a brief sketch of the structure and mode of occurrence of boulder clay, and then described fully the changes of level which this part of the earth underwent during and subsequent to the Glacial period, mentioning the various localities and sections where the order of succession of the beds indicate these alterations. The lecturer also called attention to the problems still unsolved, and pointed out work which can be done in our own immediate neighbourhood to increase our knowledge of the physiography of the Ice age.

BIRMINGHAM MICROSCOPISTS' AND NATURALISTS' UNION.—April 4th.—MICROSCOPICAL AND GENERAL MEETING.—Mr. Dunn exhibited *Melicerta ringens*; Mr. Blay, Sea Urchins from the chalk; Mr. J. W. Neville, microscopical section of Mica, showing dendritic crystals of manganese; Mr. H. Insley, Pebbles from drift beds, showing oxide of iron in dendritic forms. April 11th.—Mr. Boland showed internal Calcareous Plates from various slugs; Leaves of *Ranunculus Ficaria* infested with *Æcidium* were shown by Mr. J. W. Neville, who read a paper on "Micro Mounting in Media." April 18th.—An excursion to Bentley Quarry. April 25th.—MICROSCOPICAL AND GENERAL MEETING.—Mr. Madison showed a specimen of *Helix aspersa*, var. *exalbida*; Mr. Boland, *Helix obvoluta*; Mr. C. P. Neville, a number of Lepidostrobi found in coal measures overlap near Rushall Canal; Mr. Insley micro-section of Basalt from Bentley Quarry; Mr. J. W. Neville, a micro-section of Stem of Calamite and Bark of Lepidodendron; Mr. Baxter, Spirogyra in conjugation.

BANBURYSHIRE NATURAL HISTORY SOCIETY.—May 2nd, at Wood Green Lodge. The room was well filled, and the continued interest in the club is shown in the increasing list of members, the number now reaching seventy. After the reading of the meteorological and phenological reports, the President proceeded to give a botanical address. He took as his type flower the Buttercup, and described its various parts, which were illustrated in some of the diagrams hung round the room. After giving outlines of the broader divisions of plant life, he went on to enumerate the plants which might probably be met with in the first field excursion of the club, on Saturday afternoon, as well as those of such localities as Hanwell and Tadmaston Heath. Mr. Beesley then instanced plants which had been introduced during the forty years he had studied the botany of the district, and passed on to the reverse side of the question, enumerating many which had become extinct, such as the buck-bean, grass of parnassus, and henbane. A number of plants from Mr. Beesley's herbarium were displayed, and occasional references made to them. Messrs. E. A. Walford and J. R. Davis contributed a paper on the "Giant's Cave," near Banbury, the substance of which will appear in a future number. Amongst the objects exhibited during the evening were specimens of the Wryneck or Cuckoo's Mate, by Mr. F. F. Parker; a tray of eggs of some of the raptorial birds of Great Britain, seventeen species, of which five, viz., Hobby *(Falco subbuteo,)* Kestrel *(Falco tinnunculus,)* Sparrow Hawk *(Accipiter nisus,)* Tawny Owl *(Syrinum aluco,)* and Barn Owl *(Aluco flammeus,)* were from this neighbourhood, exhibited by Mr. O. V. Aplin. The Society's first summer excursion took place on Saturday afternoon, May 7th, at which about thirty members were present. The route taken was across the Constitution Hill fields to Bretch. The inferior and great Oolites (at the top of the hill,) which have been let down by a fault, were first examined and explained by Messrs. Walford and Stutterd, who illustrated the geology of the district by means of a large map which they had prepared. Upon reaching Bretch field many of the gentlemen of the party spent a short time in looking through the Giant's Cave. The party then separated, the greater part continuing the journey so far as the Great Oolite pits, near Tadmaston, whilst the others returned through the Crouch Lane to Banbury. Owing to the lateness of the season very little botanical work was done. Fossils from the vineyards, by Mr. C. Gillett; diatoms and fossils, by Mr. T. Beesley; microscope, by Mr. Stutterd; and Hook Norton and Chipping Norton fossils, by Mr. E. A. Walford.

BURTON-ON-TRENT NATURAL HISTORY AND ARCHÆOLOGICAL SOCIETY.—March 1st.—Rev. Chas. F. Thornewill in the chair. A paper by H. Louis, A.R.S.M., on "Dolomite and Magnesian Limestone," was read by F. Lott, A.R.S.M., F.J.C. The author pointed out that the mineral Dolomite, in which Calcic Carbonate and Magnesic Carbonate occur in approximately equal molecular proportions, is not a mixture, but a chemical compound of these carbonates. Dolomite, as it occurs with Calcite, commingled in rock, (Magnesian Limestone,) is a true mineral. Calcite can be dissolved from the rock by dilute acids, leaving Dolomite, which would not be the case if Dolomite were a mixture of Calcite and Magnesite. Dr. T. Sterry Hunt says that acetic acid, containing fifteen per cent. glacial acid, and kept at 0°C., will not, or only very slowly, attack Dolomite, whilst it will readily, even if weaker, dissolve Calcite, and that carbonated water dissolves Calcite, but will not attack Dolomite. Magnesian Limestone, much used for building purposes, is found to vary in its power to withstand atmospheric degradation; and this variation appears to be due to the amount of Dolomite it contains, as a true Dolomite is a superior building material. The author's opinion on the formation of Dolomite is that it was deposited as such through the agency of water, fresh and salt, and is not the result of pseudomorphism. Waters impregnated with magnesium salts, chloride, and sulphate, coming in contact with waters containing carbonates of the alkalies and lime, would have their magnesium precipitated as carbonate, while the sulphate of lime and alkaline salts produced would remain in solution. As Dolomite occurs in England principally in the Permian formation, it would be natural to find sulphate of lime impregnating the Sandstone and Marl of the late Permian and early Triassic formation. This is the case—a large quantity of sulphate of lime is found in water obtained from the New Red Sandstone.

CHELTENHAM NATURAL SCIENCE SOCIETY.—February 23rd.—Mr. R. Tyrer, B.A., F.M.S., read a paper on "Meteorology and its Practical Results," in the course of which he described (1) the instruments required for making observations; and (2) the practical utility and result of those observations. The paper was illustrated by excellent diagrams. Dr. Pullar afterwards exhibited a remarkable South American (Ecuador) Indian war trophy, which excited much interest. Dr. E. T. Wilson exhibited living objects under the microscope. March 23rd—Major Barnard read a paper on "The Influence of Authority in Matters of Science."

NOTTINGHAM LITERARY AND PHILOSOPHICAL SOCIETY.—NATURAL SCIENCE SECTION.—The following communications have been made to the section during the past session:—Address by J. H. Jennings, president of section, on "The Preparation of Rock Sections for the Microscope;" lecture by A. H. Simpson, F.R.M.S., on "The Chemistry of a Kitchen Fire;" paper by L. Lee, entitled "Can Evolution or Blind Chance account for those relations which are found to exist between the Organic and Inorganic Forms of Matter;" a paper by E. Wilson, F.G.S., on "The Permian formation in the North-east of England," in course of publication in these pages.

OXFORDSHIRE NATURAL HISTORY SOCIETY.—April 28th, in Geological Lecture Room of the University Museum, Professor Westwood, M.A., F.L.S., in the chair, Mr. O. V. Aplin read a paper by Mr. F. Aplin, of Surbiton, on "Bird Description," which suggested that a complete history of a bird should include the title, geographical range, habit, nidification, a description of the plumage of adult, male and female, and of the young, notice of the soft parts, and measurements of wing, tarsus, and total length of male and female. Mr. Aplin gave illustrations of the proposed descriptions, which seemed very complete and useful.—Mr. Macpherson, of Oriel College, read a very interesting paper on "London Zoology," which began by stating that the Whinchat, the Goatsucker, the Hawfinch, the Nuthatch, the Wheatear, the Blackcap, and the Spotted Flycatcher are regular visitors to Kensington Gardens, the latter even nesting there, some Wheatears are always to be found near the Reformer's Oak in Hyde Park, and that Chaffinches, Linnets, Skylarks are common in the parks, while the Great Titmouse's short but varied notes may often be heard near Holland Park, and the Cole Tit and the laughing Blue Tit have been captured in a trap-cage in Bayswater; a well-authenticated record of the Kingfisher in Regent's Park is extant. Having alluded to the occurrence of the Pipistrelle and Great Bat in Kensington Gardens, and the Long-eared Bat, which had also been found in the same locality, Mr. Macpherson described his visits to the various bird-catchers of Lisson Grove, Seven Dials, and Shoreditch. In the first-named place he saw the Siskin, a winter visitor from the North of Europe, which like the Brambling is chiefly supported on insects in their native Norwegian birch woods; here also were the little tawny lesser Red Pole, strictly confined to Great Britain, or which would be so did they not migrate into Southern Europe in hard winters, the Mountain Linnet or Twite, and the Redwing; of soft-billed summer birds, those only worth noticing were the Tree Pipit and Ray's Wagtail. Seven Dials was next explored, and Mr. Macpherson here explained that few of the Western dealers caught their own birds, but drew supplies of Linnets from Bedfordshire, &c., Goldfinches from Gloucestershire, Worcestershire, and the South Coast; notwithstanding the Wild Birds' Act, he succeeded in catching a glimpse of two fresh-caught Nightingales. The Goldfinches here seemed to be singularly deficient in the silvery markings on the tips of the secondaries, so that the Norfolk synonym, Seven-spotted Linnet, for the Goldfinch was quite inappropriate. Having pleasantly described the Hawfinches, Crossbills, and Snow Bunting, Mr. Macpherson concluded his paper by mentioning several rare birds kept in a private aviary, and giving a short account of a recent visit to the Zoological Gardens.—Mr. O. V. Aplin read a note on the occurrence of the Cornish Chough, *Pyrrhocorax graculus*, (Linn.,) near Banbury, the first record of the bird in Oxfordshire. From the contents of the crop it appeared to have been in the Midlands for some time.—The secretary, Mr. G. C. Druce, exhibited *Leucojum vernum*, from Dorsetshire, in order to explain the former occurrence of the plant in Oxon; *Gagea lutea*, or Yellow Star of Bethlehem, from some new Oxford localities; and *Muscari racemosum*, or Starch Hyacinth, once found in Shotover Plantation by Mr. Boswell, of which a single specimen had been found this year by Mr. Aplin, in the north of the county.—Mr. Macpherson exhibited a specimen of *Coronilla lævis*, or Hampshire Smooth Snake, and a male and female Palmate Newt, and a hybrid between the Linnet and Greenfinch.—Professor Westwood then exhibited and described a series of the white butterflies, *Pieris rapæ*, *napi*, and *brassicæ*, and stated that the two former species from their variability had been made into five species by some entomologists, the spring broods varying considerably from the summer broods, but it had lately been found that by hastening or retarding the development of the insect, *i.e.*, by putting the chrysalis in a warmer or colder atmosphere, the summer markings could be made to appear on the spring broods, or *vice versa*.—The President also showed some splendid plates of Lepidoptera.

MIDLAND UNION OF NATURAL HISTORY SOCIETIES.

CHELTENHAM MEETING, JUNE 16, 1881.*

THE PRESIDENT'S ADDRESS.

THE PHYSIOGRAPHY AND GEOLOGY OF THE COUNTRY AROUND CHELTENHAM.

BY THOMAS WRIGHT, M.D., F.R.S., ETC.

It affords me very great pleasure to welcome the Midland Union of Natural History Societies to Cheltenham, seeing that it forms such a capital centre for the study of the different themes which engage the attention of its members. So, therefore, instead of bringing before you again the objects of the Union and the means by which they are attempted to be attained, as has been so exhaustively done by former Presidents, I intend to devote the hour at my disposal in pointing out to you some of the subjects which are best illustrated in strict relation to our pursuits in the locality in which we are on this fourth anniversary of the Union assembled; and as this is more especially a Geological meeting, the first Darwin Medal of the Union for the best essay indicating original research on a Geological subject being about to be awarded, I shall direct your attention to the Physiography and Geology of the country around Cheltenham.

Taking up a position on any part of the high ground around the town, and casting our eyes towards the grand landscape stretched out before us, we are first struck with the wide and far-reaching valley which forms the second distance of the picture and occupies the centre of the scene, bounded on its eastern and western limits by chains of hills of surpassing beauty, varying, however, as regards age, altitude, and physical structure.

Looking westwards we see the Malvern Hills trending north and south, and showing their graceful angular line of beauty against the western sky. These hills of moderate elevation present, nevertheless, an admirable miniature model of a mountain chain, and teach us very plainly how such surface elevations of the earth's surface have been formed. The eruptive rock constituting the axis of the chain is Syenite, almost as beautiful in its physical structure as this specimen from the quarries of Syene now in my hand. The graceful angles of the ridge, so characteristic of the weathering of granitic masses, give a most picturesque feature to the outline of the Malverns, and form a physical contrast to the rounded summits of the sedimentary rocks of Palæozoic and Mesozoic age in the midst of which they stand.

The Malvern Hills are about eight miles in length and from half-a-mile to a mile in breadth, and as the chain undulates north and south we count many summits, about eight, of various heights. Commencing at the north end and proceeding towards the south we have, first, the North Hill, 1,366 feet above the level of the sea; the Worcester-

*The Council's Report, and an account of the business transacted, will appear in the "Midland Naturalist" for August.—EDS. M. N.

shire Beacon, 1,444 feet; the Herefordshire Beacon, 1,162 feet; Swinyard Hill, 946 feet; Midsummer Hill, crowned with a camp, 1,006 feet; Raggedstone Hill, 881 feet; and Keys End Hill, from 300 to 665 feet.

The passes, six in number, are Wind's Point, at the north side of the Herefordshire Beacon, 830 feet, forming the mail road to Ledbury; the Wych, 900 feet; the Silurian Pass, 875 feet, between Herefordshire Beacon and Swinyard Hill; the Valley at Fair Oaks, 575 feet, between Swinyard and Midsummer Hills; Hollybush Valley, 600 feet, between Midsummer and Raggedstone Hills; White-leaved Oak Valley, 460 feet, between Raggedstone and Keys End Hills.

The country which borders these hills is universally at a lower level for many miles around, so that from their summits the eye directed eastward glances over the wide valley of the Severn to the Lickey Hills and Cotswold range; towards the south are seen May Hill and the Forest of Dean; on the west, beyond the rich undulating woodlands of Herefordshire, appear the Skyrrydd, the Sugarloaf, the Black Forest, the steeps of Blorenge, the vans of Brecon, and the Peaks of the Berwyns; and the northern horizon is broken by the two Clee Hills, the ranges of Abberley, and the solitary dome of the Wrekin.

The striking contrast presented to the eye of the observer as he surveys the grand panoramas on the eastern and western sides of the Malverns, is most interesting to the naturalist who beholds for the first time this wondrous scene. On the east side he sees one vast undulating woody plain, varied by surface elevations, and bounded by a continuous wall of elevated ground with rounded summits. On the west side a waving surface, formed of rich narrow valleys and crested ridges between, lying at the foot of the Malverns, and forming the foreground; the middle distance of the picture is wooded with fruit trees and a luxuriant vegetation; while the extreme horizon is diversified by lofty mountains in the counties of Monmouth, Brecon, Radnor, and Salop; it was well observed by my old friend, Professor John Phillips, "That it is difficult to believe any scene more magnificent than that which is beheld on a fine evening from the Worcestershire Beacon when the sun is setting behind the far-off mountains of Wales, and the shadows of the Malvern Hills extend with a sensible movement across the broad valley of the Severn, climbing the slopes of Bredon and Cleeve, and gradually extinguishing the red light which gilds those high summits after all the regions around these have sunk into obscurity."

The Woolhope District, composed of Silurian and Devonian rocks, is seen rising in the distance beyond Keys End Hill. This region, one of the most remarkable for its physiographical features that ever came under the observation of my old friend Sir Roderick Murchison, is formed of two concentric narrow ridges of hills, almost continuously enveloping a broad, elliptical, woody dome. Each of the concentric ridges presents steep slopes, wooded towards the centre, with gentler inclinations towards the exterior. The surrounding country is much depressed, and the elevated boss of Silurian rocks describes a figure like a pear, the large rounded dome lying to the north-west, and the tapering stem pointing towards May Hill. A section across the district from the River Wye through Fownhope Park to the vicinity of Putley, in a line nearly east and west, discloses the structure of this remarkable region, and shows the geological reasons for its peculiar physiography.

The Caradoc Sandstone, the oldest rock, forms the centre of the dome, which is overlaid by the Woolhope Limestone, the concavity around being excavated out of the Wenlock Shales; the inner ring of hills are formed by the outcrop of the Wenlock Limestone, flanked by the Lower Ludlow Shales ; and the outer chain of high ground which borders the whole of this interesting region is formed by the Aymestry Limestone and Upper Ludlow Flags and Shales, dipping everywhere away from the centre towards the wide area of the Old Red Sandstone.

The MAY HILL DISTRICT.—Yarleton or May Hill is easily recognised from the valley by its dome-shaped summit, crowned with a clump of trees, and elevated 972ft. above the level of the sea, forming an extension southwards, or an outlier of the Silurian Rocks so well exposed in the Woolhope district. Like that region, the Caradoc or May Hill Sandstone is the oldest sedimentary deposit, and consists of an upper, middle, and lower division, the upper part formed of thin-bedded Sandstones and grayish Shales, with bands of fossils, all in the form of moulds, extremely abundant, sharp, and well-defined ; the middle part formed of thick Sandstones, with bands of pebbles passing into Conglomerate, and fossils the same as in the upper portion ; the lower part contains Conglomerates full of rolled quartz, pebbles, and pieces of felspar, cemented together by finer grains, and occasionally much indurated. On the flanks of the dome are beds of Woolhope Limestone, well exposed in roadside sections between Huntly and Mitcheldean, and showing a series of nodules and lumpy irregular beds alternating with Shale for a considerable thickness. The *Wenlock Shale* is but little exposed on the flanks of May Hill. The *Wenlock Limestone* is extensively so, and is quarried for building and agricultural purposes in long continuous channels along the crests of the woody hills encircling the Caradoc dome. Fossils are very abundant, and corals especially in the lower beds. The *Ludlow Rocks* are well exposed in several localities on the western side of the hill, where the beds may be traced down to the Wenlock Limestones, whilst on the eastern side they graduate into the Old Red Sandstone. The Ludlow Rocks are very fossiliferous in parts, and are well exposed in several sections.

The DOWNTON SANDSTONE is seen on the eastern side of May Hill, where it is quarried for flagging and walling. These Sandstones consist of light-coloured laminated beds, which lie between the Gray Shales of the Upper Ludlow and the Old Red Sandstone. They contain some vegetable but no animal remains.

The OLD RED SANDSTONE becomes largely developed in the vicinity of May Hill, swelling out to 5,000 or 6,000 feet in thickness, and almost entirely without fossils, with the exception of a few bones or scales of fishes.

The Forest of Dean adjoins May Hill, and presents us with a new assemblage of strata; for in the basin formed by the Old Red Sandstone lie the valuable carboniferous and ferruginous deposits of the Forest of Dean, supported by masses of Carboniferous Limestone, and thinner bands of Shales and Sandstones, so that in descending order we have the following strata:—Coal Formation, Millstone Grit, Mountain Limestone, Lower Limestone Shales, and Old Red Sandstone.

The Carboniferous Limestone of the Forest of Dean is not more than one-third the thickness this formation attains in the Avon section. The Lower Limestone Shales, 165 feet thick, are very fossiliferous, consisting of alternations of Shales and Limestone, full of the ossicula of crinoids, with a bone-bed near their base. The main Limestone contains a succession of Brachiopoda, as *Spirifera*, *Producta*, and *Orthis;* of Lamellibranchiata, as *Aviculo-pecten*, *Cardiomorpha*; Gasteropoda, *Euomphalus* and *Bellerophon;* Cephalopoda, as *Goniatites*, *Orthoceras*, *Actinoceras*, with the teeth and defensive spines of fishes. Some of the coral beds in the upper part of the series are rich in specimens of Actinozoa, belonging to reef-building groups of the ancient seas, as *Michelinia*, *Amplexus*, *Lithostrotion*, *Syringopora*, *Lonsdaleia*, and others, and reminding us of the structure of the coral reefs of the present day. There are some interesting local accumulations of peroxide of iron, intermingled with the calcareous deposits of the Forest of Dean, so that we should regard the iron as having constituted a portion of the rocks. These ferruginous deposits have been long extensively worked and their mode of occurrence well understood. They have always the same geological position, cropping round the basin-formed mass into which the beds of Dean Forest have been forced, and differing from the hematite iron ore known elsewhere among the carboniferous rocks of England and South Wales, where the hematite is found in veins which cut the strata like mineral veins, whereas in the Dean Forest the iron deposits form a series of contemporaneous interbedded accumulations of the general carboniferous strata.

The Coal measures of the Dean Forest attain a thickness of 2,765 feet, and contain fifteen seams, of which eight are of a thickness of 2ft. and upwards. The thickest seam is about 5ft.: along the south-west side of the coalfield the Millstone Grit and Carboniferous Limestone are overlapped unconformably by the coal measures, according to Mr. R. Gibbs.

All the rocks we have surveyed from the western side of the Malverns, Woolhope, May Hill, and the Forest of Dean are of the Palæozoic age, and were raised and contorted either by eruptive agencies or a series of plissements in post-carboniferous and pre-triassic times, as is very well shown in this section of the Malvern Hills, where the Keuper Sandstone is seen to abut against the Syenite, and from this point commences our review of the Mesozoic Strata, which occupies the wide valley of the Severn, and stretches in a north-westerly direction through the counties of Worcester, Stafford, and Cheshire into the Irish Sea, and in a northern line through Warwick, Leicester, Nottingham, and York to the German Ocean.

The Trias in England consists of two divisions, the Bunter and Keuper, the middle member so well known on the Continent (the Muschelkalk) has not yet been identified in our country.

On the western side of the valley the Keuper is exposed, consisting of *a*, Red Variegated Marls; *b*, Lower Sandstone Marl; and *c*, Dolomitic Conglomerate. Several good river sections of the variegated Marls are seen on the banks of the Severn, as at Wainlode Hill, near Tewkesbury, Garden Cliff, near Westbury, and Aust Cliff, near the old passage. The Bunter or New Red Sandstone does not occur in the valley.

Between the uppermost beds of the Grey Marls of the Keuper and the lowest beds of the Lias occurs a remarkable assemblage of strata, which have caused a considerable amount of discussion as to the place they ought to occupy among the secondary rocks, and which I long ago described as the *Avicula contorta* beds, in consequence of that bivalve shell forming one of the leading fossils. Typical sections of these strata are well exposed near Coombe Hill, half-way between Cheltenham and Tewkesbury, in a road cutting leading down to the canal; at Wainlode Cliff, near Apperley; and still better, at Garden Cliff, near Westbury-on-Severn, where a magnificent exposure of these beds, resting on the Keuper, and overlaid by the Lias, is laid bare by the river. In the upper part of the section are dark-grey Shales, intersected by bands of Limestone, in which *Avicula contorta*, *Cardium Rhæticum*, *Axinus*, *Pecten Valoniensis* are gathered. In the lower part is a hard, dark grey siliceous grit, full of bones, spines, scales, and teeth of fishes, belonging to the genera *Nemacanthus*, *Acrodus*, *Sargodon*, *Hybodus*, *Ceratodus*, &c. This assemblage of organic *debris* constituting the bone bed, is claimed by Palæontologists as the uppermost member of the Trias, seeing that the fish remains all belong to Trias forms, and by others it is considered as the lowest portion of the Lias. I consider the former as the correct determination. The remarkable teeth of *Ceratodus*, that were found in the bone bed of Aust Cliff, first brought these strata into notice, and the Bristol Bone Bed, as it was long called, became classical ground to the Geologist. It is now ascertained that a representative of this genus, once supposed to be extinct, now lives in the rivers of Queensland.

The Lias Formation

Occupies the eastern side of the vale, and two-thirds of the western escarpment of the Cotteswold Hills are formed of Lias, which, likewise, is here the basement rock of the Jurassic strata.

The Oolitic Rocks admit of a division into a Lower, Middle, and Upper series. Each of these groups rests on a great argillaceous formation, upon which repose calcareous strata, composed of brown and yellow sands and cream-coloured Oolitic and Pisolitic Limestones. The argillaceous strata form wide valleys, which extend diagonally across England, in a north-easterly and south-westerly direction, the high ground, composed of Limestone, forming low ranges of hills, with escarpments facing the south-west and overlooking the valleys. The Lower Oolites rest on the Lias, the Middle Oolites on the Oxford Clay, and the Portland or Upper Oolites on the Kimmeridge Clay.

The Lias formation is well developed around Cheltenham, but not often exposed. Railway cuttings, brick-yard pits, and the marlstone quarries of several localities have yielded a large series of its characteristic fossils in good preservation. The Lias formation stands conspicuous among the Mesozoic Strata in the completeness of its record, for the chapters of its life-history are written in enduring characters on its dark Shales and Limestones, and which can be deciphered with a certainty that is very remarkable ; in this respect it presents a favourable field for tracing the course of life during the long period of time its strata were slowly accumulating. The Lias, therefore, forms an exception to the general assertion that the Geological record is imperfect, and, as a consequence, the study of its organisms merits a careful study by all who are engaged in attempting to expound theories of the earth.

It has been often repeated of late years that the Geological record is imperfect, and that many of the leaves, and even some of the chapters of the great Rock-book, on which the hieroglyphics of its history were written, are wanting ; yet " time, which antiquates antiquities, and hath an art to make dust of all things, hath yet spared these minor monuments," for it is certainly true that the Lias formation contains a marvellously complete record of the succession of life in time during the long period occupied in its accumulation, and which, when critically compared with the fauna of the Triassic Strata which preceded, and the Oolitic Rocks which succeeded it, shows a marvellous marked difference in the reptiles, fishes, cephalopods, echinoderms, and corals that lived in these two different periods of Mesozoic time. The Lias is divided into Lower, Middle, and Upper, and each division is characterised by a distinctive fauna ; many of the strata abound with cephalopods, whose shells form leading fossils by which these three divisions of time are recognised wherever the Lias formation is exposed.

The Lower Lias is divisible into seven, the Middle into five, and the Upper into three zones of life.

Besides the ammonites which well identify the strata, each zone contains an assemblage of gastropods and conchifers, special to the beds, so that each horizon of life becomes a special object of study to the Palæontologist.

The Lower Lias beds are found in the valley, the Middle in the lower slopes of the Cotteswolds, and the upper capping the Middle Lias, and interposed between it and the Lower Oolites.

The reptiles that appeared in the Lias seas, estuaries, rivers, and land, present us with some of the most marvellous combinations of structure that we are acquainted with among the vertebrata. Three distinct groups are here found—the *Enaliosaurians*, or marine reptiles, the *Pterodactylians*, or aerial reptiles, and the *Teleosaurian*, or land and river reptiles.

Among the Enaliosaurians, the *Ichthyosaurus* will always stand supreme. This marvellous animal had the skull of a crocodile, the eye fashioned like a bird and a turtle. It had the backbone of a fish, the paddles of a whale, and the scapular arch of a *Platypus*.

The *Plesiosarus* was distinguished by its long neck resembling that of a swan united to the trunk of a quadruped, with ribs like a chameleon. The structure of these Enaliosaurians may be pointed out as specialised examples of ancient osteology which had no ancestors in the Trias, and no descendant beyond the Jurassic age.

There is yet another reptile that appeared for the first time in the Lias, which has indeed a unique history, seeing that nothing approaching to it is found either in living or extinct natural forms. This is the *Pterodactyle*, a flying reptile whose skeleton was modified and adapted to an aerial life ; it had some resemblance to bats and birds, but was widely different from both. In bats the whole anterior extremity is elongated to form the framework of a wing, but in the Pterodactyle it was only the little finger that was lengthened and strengthened to become a rod for supporting a membrane, whilst the other parts of the hand, the thumb and three inner fingers, retain their normal size. Like birds, the long bones of the arm are hollow cylinders, and it differed from birds in having the skull of Reptilia, and its jaws were armed with long teeth implanted in distinct sockets. The first Pterodactyle, *Dimorphodon Macronyx*, appeared in the Lower Lias of Lyme Regis, and is another example of specialised osteology, of which as far as is known no traces of ancestry can be found in the Trias formation.

The *Teleosaurian*, or land and river reptiles, appear in the Upper Lias. Several examples of small specimens have been found in the fish bed at Dumbleton, and in the same formation in Somersetshire, as well as in the Upper Lias of Yorkshire.

The wide contrast between the reptiles of the Lias and those of the Trias was brought forcibly before me last summer when studying the Würtemberg Ammonites in the Stuttgart Museum, where capital specimens from both of these formations are introduced at the same moment to the eye of the observer by being preserved in large cases placed on opposite sides of the saloon. After a careful study of these remains I failed to discover any genetic relations between the fossil Reptilia of these two periods of Mesozoic time.

Fishes are very rare in the Lower Lias of this region, but the fish bed of Dumbleton in the Upper Lias has yielded some fine large specimens of *Leptolepis*, *Pachycormus*, and *Tetragonolepis discus*.

The *Cephalopoda* form the highest class of the Mollusca, and are remarkable for their abundance in the Lias, and for the important part they played in the eventful life-history of that period. The class is divided into two orders. The naked cuttles, without an external shell and breathing by two gills, form the *Dibranchiata*, like the common cuttle-fish.

The occupants of a many-chambered shell, and breathing by four gills like the Pearly Nautilus, form the *Tetrabranchiata*. To the Dibranchiates belonged, it is supposed, the animal of the Belemnite, which first appeared in the Lower Lias sea, but no ancestral form of this mollusc is known in the Trias. It rapidly multiplied during the Middle Lias time, and its internal bony skeleton is so abundant in some strata that they were called the Belemnite beds by De la Beche, and Belemniten-schichten by German geologists. All the naked cuttles are furnished with an ink-bag, containing a dark-coloured pigment, which is very miscible in water, and in some of the specimens from the Upper Lias this fossil pigment is well preserved.

The Tetrabranchiates, with a many-chambered shell, are well represented in all the Lias beds, the only living representative of which is the *Nautilus pompilius*. This family is the oldest; it commenced its career in the seas of Silurian times, and under many singular generic forms it has lived on into the present day, and is well represented by the *Nautilus striatus* from the Lower Lias of the vale, now on the table, which closely resembles the *Nautilus pompilius* of the Indian Ocean.

The *Ammonoida* differ from the *Nautiloida* in having the side partitions of their chambers terminating in various angular or foliated figures, seen in its highest complication in some Ammonite shells. This order commenced in Devonian times with the genus *Goniatites*, they flourished in the Devonian and Carboniferous seas and died out in the Lias. They were succeeded in the Muschelkalk by the *Ceratites*, with small serrations on part of their lobe-line. The Hallstadt Trias contains a wonderful assemblage of *Ammonites* possessing *small complicated lobe-lines* of singular minute patterns, and these were succeeded in the Lias by the Ammonites with *large highly foliated lobe-lines*.

This group is divisible into four families. First, the *Arcestidæ*; second, the *Tropitidæ*, which appertain almost entirely to the Trias, whilst the other two families—third, the *Aegoceratidæ*, and fourth, the *Lytoceratidæ*, are distributed in the Lias, Jurassic, and Cretaceous rocks; certain genera in each family become leading fossils in different strata, so that each division of time in the Lias sea was characterised by species of Ammonites found only in beds of the same age and horizon, and which have a wide distribution in time and space therein.

The oldest Ammonites, *Aegoceras planorbis* and *Aeg. angulatum*, are probably descended from Triassic forms, of which, however, we at present know nothing. The great group Arietites, with prominent keel and bisulcated siphonal area, are highly characteristic of the Lower Lias, and *A. Bucklandi*, *bisulcatus*, *Conybeari*, *rotiformis*, and *semicostatus* are found only in these beds, as was long ago pointed out by Von Buch.

In the Middle Lias the genus *Aegoceras* attains a great development, and *Jamesoni*, *armatum*, *planicostatum*, *Henleyi*, *Davei*, *Valdani*, *Bechei*, and *striatum* come out in great force therein. The Upper Lias contains a remarkable preponderance of the genus *Harpoceras*, such as *falciferum*, *serpentinum*, *bifrons*, *ovatum*, and *variable* with *Lytoceras* and *Stephanoceras*, in variable proportions of specific forms.

These few examples are sufficient to illustrate the general character of the laws that determine the distribution in time and space of the Ammonitidæ of the Lias, and teach us that new groups of chambered shells fill the different zones of the Lias, which have no genetic relations with the forms that prevailed in Triassic times.

The Gastropods and the Lamellibranchs of the Lias follow the same general law of distribution as the Ammonites; the three great divisions of Liassic time having their own groups of organisms appertaining to these classes, and strictly limited to them.

The *Crinoids* of the Lias deserve some special notice, seeing that they differ so widely from the Triassic form of *Encrinus moniliformis*. The genus *Pentacrinus* suddenly makes its appearance in the Lower Lias sea in the form of *P. tuberculatus*; in the Middle Lias we have *P. robustus* and *P. briareus*, the latter covering large slabs with its numerous arms on the Dorsetshire coast; in the Upper Lias we find that remarkable species *Pentacrinus Hiemeri*, whose long stems, many feet in length, are coiled beneath the calyx. I have seen in the Stuttgart and Tubingen Museums many wonderful examples of this species, which have long stems many yards in length.

Many beautiful examples of *Ophiuridæ* and *Asteriadæ* are found in the Lias, and some fine sea-urchins, resembling existing species; but my limits forbid me entering upon the description of these interesting fossils; enough, however, has been said to convince you that the Lias contains a magnificent succession of life, embedded in strata that succeed each other in regular order without those breaks in the continuity of deposition which render the geological record imperfect in some other formations, but which in the case of the Lias presents us with a regular superposition of the stratigraphical series from the bottom to the top,and affording a faithful record of ocean life during one of the most remarkable periods of Mesozoic time.

The Cotteswold Hills form an elevated tract of land, having an average elevation of 750ft. above the sea level, and extending in a north-easterly direction through the county of Gloucester, rising abruptly from the plain, and presenting a bold escarpment to the north-west. The outer line of these hills commences near to Bath, and undulating first westward and then northwards for upwards of sixty miles, terminates in the bold headland of Ebrington Hill.

The southern section of the chain is of inconsiderable height, but towards Wotton-under-Edge Symonds Hall Hill rises to 810ft. and Standish Hill 715ft., which runs out into the conspicuous promontory of Stinchcombe Hill, 725ft. high, stretches far westward into the valley, and from its wooded sides and turf-clad summit some of the finest panoramic views of Gloucestershire are obtained. North of Stinchcombe the chain recedes easterly, and forms a deep bay, surrounded by high wooded hills, in which the town of Dursley is situated. In the vicinity, the denudation of the high ground has left some singular outlines, as Camlong Down, with its rounded sands, and Uley Bury, 823ft., with its Roman camp. From thence the chain still trends northwards to Frocester, 780ft., Buckholt Wood, Long Wood, and Selsley Hills, which bound the southern entrance to the Nailsworth, Stroud, and Chalford Valleys, forming the great southern pass, and dividing the northern from the southern Cotteswolds.

White Hill forms the north cheek of this valley, then comes Haresfield Beacon, with its wooded summit, stretching far northward in advance of the main line, which now again trends north-easterly, is depressed near the Horsepools, and rises again into high ground at Painswick Beacon, 929ft., with its Roman camp.

The heights that follow are Cooper's Hill, Birdlip Hill, 969ft., over which the great Roman pass, the Ermine way from Gloucester to Cirencester, was trod by the Legions. Then comes Leckhampton Hill, 978ft. This promontory bounds the fourth pass, and its steeply-scarped sides form the southern cliffs of the grand bay that opens into the Dowdeswell Valley, and leads into the fifth pass over the Cotteswolds. Near the entrance to this bay nestle Cheltenham, Charlton Kings, and Leckhampton. The chain now trends out north-westerly far into the vale, and forms Cleeve Cloud, 1,081ft., which is the highest summit. Then follow Notting and Stanley Hills. The luxuriant valley, in which Winchcombe and Sudeley Castle are situated, forms another deep narrow bay. The main chain now undulates north-easterly, with rounded swelling summits, by Middle Hill and Broadway, and terminates in the outlying promontory of Ebrington Hill, which overlooks the Vale of Evesham and the great eastern plains in the counties of Gloucester, Worcester, and Warwick.

The Outliers of the Cotteswolds merit a special notice as picturesque objects in the physiography, and admirable keys to the geology of the region.

Robin's Wood Hill, 652ft., occupies a conspicuous position in the valley near Gloucester, being a complete outlier from the main chain, from which it has been severed by denuding agencies. It is capped with Oolitic Limestone, and its rugged sides, wrinkled by ancient landslips, impart to it a peculiar outline of its own, rendering it one of the most picturesque of all the outliers.

Churchdown rises to an inconsiderable height, its Marlstone sides being finely wooded, whilst its forward position renders it a capital look-out for studying the physiography of the region, and observing the undulations of the western wooded slopes of the adjoining hills, and the magnificent outline of the high lands that bound the western horizon. Oxenton Hill, 733ft., like Robin's Wood, is capped with Oolite, and forms a considerable mass, well separated from the chain, and Alderton, Dumbleton, and Dixton resemble Churchdown, being largely formed of Marlstone, having a rich soil for forest trees, are well wooded.

These hills, however, are mere dwarfs when compared therefrom with Bredon, 979ft., at the base of the tower, by far the largest of all the outliers of the Cotteswolds. This hill stretches across the valley, and forms a mountain barrier between the Vales of Evesham and Gloucester. It presents a bold front towards the north, with tabulated bluffs of Marlstone, and an escarpment of inferior Oolite, which crowns the hill. On the south it is gently rounded towards the plain, a form of structure due, it would appear, to a fault which traverses the hill from east to west along its southern termination, producing a downthrow of the Upper Lias Shale, and Inferior Oolite against the Lower Lias of the plain.

The structure of the Cotteswold Hills is extremely simple, the lower portion of their western slopes consisting of Middle Lias Shales, and bluffs of Marlstone, on which rest the Upper Lias Clay and Ferruginous Sands, the whole being capped by Oolitic Limestone.

Leckhampton Hill exhibits one of the most typical sections in the county of the three sub-divisions of the Inferior Oolite. In general terms, it may be said to consist of three ancient Coral Reefs, with intermediate shelly beds of Oolitic Limestones superimposed upon each other. Resting upon the Upper Lias Sands we have (1st) the Pea-grit, a brown ferruginous pisolitic Oolite, full of flattened concretions, like crushed peas, and abounding with Echinoderms and Mollusca. Among the former are *Cidaris*, *Stomechinus*, *Acrosalenia*, *Pseudodiadma*, *Polycyphus*, *Pedina*, *Hemipedina*, *Pygaster*, *Galeropygus*, *Stellaster*, and *Pentacrinus*. Of the latter are thirty-six species of Lamellibranchiata, twenty species of Gasteropoda, four species of Cephalopoda, with many Polyzoa and Annelida. Above this comes the Lower Coral Reef, well seen "*in situ*" at Brown's Hill, near Stroud, consisting of nodular masses of Coralline Limestone, embedded in a cream-coloured Mudstone, many of the Corals being highly crystalline. Here I have found *Latomeandra*, *Thamnastræa*, *Isastræa*, *Axosmilia*, *Thecosmilia*, *Montivaltia*. The Coral bed is overlaid by a coarse brown ferruginous Oolite, forming the Lower Ragstones, and containing *Terebratula simplex*, and *T. plicata* in considerable numbers.

The Building Freestones come next. They consist of thick-bedded Oolitic Limestone, very hard and light-coloured, and emit a metallic ring when struck with the hammer. The fossils are nearly all fragmentary and indeterminable, and at Leckhampton they measure 110ft. in thickness. Superimposed upon the building beds comes the second Coral Reef, forming the Oolite Marl, consisting of a cream-coloured Marl, with inconstant layers of Mudstone, the upper part passing into a loose friable Freestone. Here are found in great numbers *Terebratula fimbria* and specimens of *Thamnastræa*, *Isastræa*, *Axosmilia*, &c. Associated with these are shells of *Nerinæa*, *Natica*, and *Chemnitzia*, and masses of Coral, chiefly *Thamnastræa Mettensis*. This *Fimbria* bed is a constant member of the Inferior Oolite in the Cheltenham district and in the Northern and Middle Cotteswolds, but appears to be absent in the Southern part of the range.

The Middle Coral bed is overlain by a rich shelly Oolite, abounding in many species of Mollusca that are not found in the Pea-grit series, and notably appear here. Several species of Ammonites, that well characterise this zone, as *Stephanoceras Humphriesianum*, *S. Brongniarti*, *S. coronatum*, *S. Braikenridgii*, *S. Brocchi*, *S. Gervillii*, *Harpoceras Sowerbyi*, with several species of Gastropods, belonging to the genus *Pleurotomaria*, as *P. fasciata*, *P. elongata*, *P. punctata*, and *P. constricta*. The Lamellibranchiata likewise belong to species that are found only in these beds. The best types of this zone of Jurassic life are the Ferruginous Oolites of Dundry, Yeovil, and Burton Bradstock, in England; and the lower half of the "Oolite Ferrugineuse," of Bayeux, in France.

The Lower *Trigonia* bed rests upon the preceding, and consists of a thin-bedded Oolitic Ragstone containing many very fine well-preserved fossil bivalve shells.

The *Gryphæa* bed, almost entirely composed of the valves of *Gryphæa sublobata* and several other shells, imbedded in a hard calcareo-siliceous matrix, which formed an oyster bed in many portions of the Northern Cotterwolds.

The *Globata* bed rests upon the preceding; it is a hard, shelly Limestone, full of the shells of Brachiopoda, of which *Terebratula globata* and *Rhynchonella spinosa* are here in abundance.

The Upper Coral Reef consisting of masses of highly crystallised Coralline Limestone, rests upon the *Globata* bed, *Thecosmilia gregaria*, *Thamnastræa*, *Isastræa*, *Montlivaltia*, are here found. The Ammonites are *Parkinsoni* and *Martinsii* and the Echinoderms are *Clypeus Plotii*, *Echinobrissus clunicularis*, *Holectypus depressus*, *Disaster ringens*, and *Pedina rotata*.

All the formations I have thus passed rapidly in review represent a considerable proportion of the stratified rocks of the earth's crust, and embrace many of the Palæozoic and some of the Lower and Middle members of the Mesozoic series. All these ancient formations may be studied from Cheltenham as a centre without requiring the student to spend one night from his home, thus showing what a remarkable centre in the midland district this locality is for Geological study.

I now turn to another subject upon which I desire to say a few words to this annual gathering of Midland Naturalists relating to the progress which the Natural Sciences have made during the last half century. At the beginning of that period comparatively little attention was paid to our favourite studies, either by the Universities or scholastic bodies. It is true that Sedgwick, at Cambridge, Buckland, in Oxford, and Jamieson, in Edinburgh, had classes on Geology; and Professor Grant, about this time, commenced his splendid and exhaustive course in University College, London, on Comparative Anatomy; Dr. Allmann was lecturing on Botany, in Trinity College, Dublin: and the late Sir William Hooker, on the same subject, in Glasgow; but Biological Science in general was little attended to in these Natural History courses, and it had not then been introduced into other institutions. About this time, however, important improvements were made in the construction of the microscope and object glasses of high quality in power and definition, were made by Ross, Powell, Smith, and Beck in England; and valuable instruments were likewise constructed by the opticians of France and Germany. Ehrenberg's great work on the Infusoria had been lately published, and the marvellous forms of animal structure, which were so beautifully delineated in the plates of Die Infusions-Thierchen, brought microscopical science to the front, a position which it has ever since maintained.

Physiology was very badly taught in our Medical Schools fifty years ago, the microscope had not then been introduced as an instrument of research, otherwise I should have been enabled to describe the *Trichina spiralis*, which I was the first to discover in the muscles of a female brought into the Royal College of Surgeons, Dublin, in 1830; three years before that Entozoon was seen and described by my old friend, Professor Owen, in London.

The laboratory studies made about this period, more especially by Tiedemann in Germany, Majendie in France, Charles Bell in England, on the Brain and Nervous System, gave a new direction to the lines of Physiological research and brought other observers into the field, notably Professor Matteucci, of Pisa, who, in 1844, gave courses of experimental lectures on the "Physical Phenomena of Living Beings," by which the importance of laboratory work was made more apparent to students of Biology. The translation of Muller's exhaustive treatise on Physiology, by Dr. Baily; and Wagner's, by Dr. Willis, with the several excellent works by Dr. Carpenter and others, formed a new basis for teaching Physiology in schools, by shewing the importance of microscopic observations in Histology, and laboratory experiments in Physics and Chemistry, with the view of clearing away the haze of ignorance which had so long hung over many of the functions of organic life.

The establishment of Biological laboratories in Edinburgh, Cambridge, Oxford, and South Kensington formed an important era in the study of the Natural Sciences, which will soon bear important fruit both in the University life and popular education of our fatherland. Already we see some of the foremost of the University students distinguishing themselves in the "Challenger's" work, and the South Kensington lectures and demonstrations are destined to prepare the mind of the future schoolmaster for disseminating the elements of Natural Science in our National Schools. This is indeed beginning at the right end of the story, and is one of the most hopeful signs of real progress in our favourite pursuits. Germany has long utilised its Professorial ability in training the Schoolmaster to fit him for his work, and we cannot follow a better example in this line than the one set us by our Teutonic neighbours in this branch of National Education.

Already nearly all the great schools in England, as Eton, Harrow, and Rugby; and Wellington, Clifton, Marlborough, and Cheltenham

Colleges have introduced Science Classes into their curricula, and established laboratories for Chemical and Physical work in connection with professorial instruction. All this bids fair for the future, and if the teaching in these establishments prove to be real, and habits of correct observation are formed, and the whole prevented from becoming corrupted by *cram*, then the result will be a success.

The Ladies' Colleges have followed in the same line, indeed the Cheltenham Ladies' College has had regular courses of lectures on several branches of natural science during the last twenty years, so that, instead of following, this noble institution has led the way in this path of progress.

Geology and Palæontology have always occupied a foremost rank among the Natural History studies of our country since Dr. William Smith raised Stratigraphical Geology and the study of Organic Remains to the dignity of a science.

The Geological Society of London, by the incessant labours of its Fellows, and the Geological Survey, by its Maps and Memoirs, have shown that no country stands higher in practical work and good workmen than Britain, and no other country has raised such a monument of unpaid industry as the Palæontographical Society has done, represented here to-day by its most worthy Secretary, my old friend, the Rev. Professor Wiltshire F.G.S. The 35 grand quarto volumes which it has published, full of more than 1,400 plates, and containing upwards of 25,000 figures of British fossils, shew that we have good stuff in our ranks who have worked for honour and declined the pay; and this great national work is pointed to with admiration by the naturalists of both worlds as one of the greatest achievements voluntary labour in Natural Science has ever attained.

The Natural History, Microscopical, and Natural Science Societies, together with the Naturalists' Field Clubs, which form the Midland Union of Natural History Societies, and others of a like character that have sprung up throughout the land, are so much healthy evidence that great progress has been made during the last fifty years in disseminating a knowledge of Natural Laws, and assisted to leaven the public mind and bring it more into sympathy with our studies. During all my professional life I have been the consistent and continuous advocate for the introduction of the teaching of the elements of Natural Science into schools and colleges, well knowing that were the first difficulties in the pursuit of these studies overcome in school life, we should have better observers and more numerous students in after years. I confess I never could understand the dogged opposition this proposal met with from some Head Masters of Schools and College Authorities, which, in my simplicity, only meant that the youth of the nineteenth century required a better and a wider training than those of the fifteenth. For a long time I felt the attempt was hopeless, but the various phases of progress which I have glanced at in this address have converted the dream of my youth into a reality to-day; and I can only congratulate you on the success which has crowned the efforts of those who in their various spheres have in any way contributed to the result.

There is a perennial freshness in the study of Nature which animates all true naturalists, and enables them to overcome obstacles and difficulties which beat other men, and this *vis medicatrix naturæ* has been one of the main secrets of the success of those who have omitted no opportunity of pressing forward the teaching of Natural Science in schools and colleges, and at length attaining that measure of success which has already crowned our efforts, and which it is the sacred duty of the Midland Union to promote by every means in its power.

RECOLLECTIONS OF A TOWN GARDEN.

The garden I am about to describe is situated in one of the cathedral cities of the Eastern Counties. This city was once an important Roman station, and the garden is mainly formed of part of the Roman moat which here runs in a northerly direction for about 200 yards, and then turns to the west. It is at the back of a house which faces the street to the south, and is bounded on the east by a high stone wall (covered with ivy) for about eighty yards, and for the whole length by a row of very old and tall small-leaved elms. On the west, parallel with the other wall, is another, the remains of that built by the Romans, and from one end to the other of the moat on this side a gravel path runs. The northern boundary of the garden is where the moat turns to the west and becomes a paddock, a hedge and path divides them, and at the angle on the top stands an octagonal summer-house. At the point where the walls end, that is, at about eighty yards from the house, the moat was formerly spanned by a rustic bridge, but this having decayed it was replaced about thirty-five years ago by a bank the same height as the gravel walk, thus cutting the moat in two. That part nearest the house was partly filled in, and laid with turf, forming a spacious lawn, shaded on each side by trees and shrubs, and at the bank end by two graceful copper beeches. The other half of the moat was left in a semi-wild state, the banks being covered with grass and planted with trees.

The Roman wall must have been strong and solid, but it has been pillaged of its outer coat of large hewn stones, and now consists only of the inside rubble, though a piece with some of the outer stones left may be seen in an adjoining paddock. At the north end of the wall there is a kind of grotto and rockery formed of old stones and large burrs; the grotto, being furnished with a door and a small window, has been the home at different times of an owl, a hawk, guinea pigs, &c. It is reached by a few rough steps in the rockery, and the roof of large slabs of slate afforded a favourite playplace for the children of the family. Near it grows a large old elm tree with very small leaves, the same species as those forming a row on the other side of the moat. I do not know the name of this elm, it is very tall, and the branches grow in an upright direction, and do not spread far from the stem. The holes in the trunks afford convenient nesting places for starlings, and the dead boughs favourite perches for them and for jackdaws, wood pigeons, and young swallows. Besides the elms there are some very fine sycamores, one in particular which overshadowed the lawn, the others are in the far part of the moat called the "Hollow." Nothing to my mind is more pleasing to the eye than a well-shaped sycamore in spring, with its leaves well developed, and covered with the graceful pendulous blossoms; at the same time its appearance is very easily spoilt at that time of year by a gale of wind.

At the extreme end of the garden, and near the path, grew three or four very old larch trees, each consisting of a tall and straight trunk, with a circle of boughs at the top, giving it somewhat the appearance of an umbrella. One of these old fellows having been blown down, sufficient wood was sawn out of the trunk to make a cabinet to hold antiquities. A fair-sized hornbeam, an acacia, an ailanthus, a couple of maples, and some thorns about complete the catalogue of trees. The soil is very suitable for thorn trees, and double white, double pink, single red, and other kinds were to be seen. Hollies, too, did well; but most kinds of pines lost their lower boughs after reaching a certain age, and looked sickly. Austrian pines grew slowly, but succeeded the best. The soil is light and poor, resting at no great distance on the Oolite rock; and the air of a town not being very suitable to flowers, the late owner turned his attention more to flowering shrubs, so the garden was gay in spring and summer with lilacs, laburnums, and Guelder Róse, besides others, the names of which I do not know, and which I have never seen anywhere else. One, which flourished and flowered well under trees, is called, I believe, the Canadian Rose.

The Roman wall is partly covered with different kinds of ivy, and an elder has taken root and projects at right angles from it, meeting a thorn on the other side the walk. Wallflowers are plentiful, and there is a single white pink, originally brought from Leeds Castle, in Kent, and which is said to grow wild there, but no *white* pink is described in any British Botany book. It is fringed, and probably the original of the common white pink. The Creeping Toadflax, *(Linaria Cymbalaria,)* House Leek, *(Sempervivum tectorum,)* and Poor Man's Pride, *(Sedum reflexum,)* about complete the list of denizens of the wall. At its foot, as well as in the "Hollow," grew two species of the Borage family, one with blue, wheel-shaped flowers, and rough leaves, I think the Evergreen Alkanet, *(Anchusa sempervirens,)* and the other also had rough leaves, but the flowers were whitish and tubular, the common Comfrey, *(Symphytum officinale.)* The only other really wild plants which obtained a footing, and are worthy of mention, were the great Celandine *(Chelidonium majus,)* the Common Mallow, *(Malva sylvestris,)* the Broad-leaved Willow Herb, *(Epilobium montanum,)* and the Common Avens, *(Geum urbanum.)* These flourished about the "Hollow," which, in spring, was carpeted with snowdrops, primroses, and violets. The snowdrops were double, and most of the primroses coloured, proving that they must have been planted by the hand of man at some remote time; nevertheless, the later generations must have been self-sown, and had all the appearance of wild flowers dotted about amongst the grass.

The Hollow was divided from the long walk by a lilac hedge, and on the other side there was an elder hedge under the row of elms. These hedges were favourite nesting places for birds, and here I may remark that the number of birds frequenting this garden was quite surprising, surrounded as it was, though at some little distance, by houses. I am inclined to agree with the author of "Wild Life in a Southern County," that when birds have once become attached to a particular locality they stay there, even though it may be much more frequented than formerly. This, however, was not the case with the rooks which are said to have built in the elms; they have not done so for many years, but come from neighbouring rookeries every spring to fetch sticks, wasting, as they always do, twice as many as they carry away. Some years ago, before any villas were built to the north of the garden, it was not unusual to flush a woodcock from the Hollow in October. They no doubt found it a pleasant resting place on their journey from the coast. A pair of wood pigeons built annually either in the larch trees, the copper beeches, or the pines. Song thrushes and blackbirds were constant residents all the year round, they built chiefly on the ivy-covered walls and trees. A pied blackbird was a visitor for some months, but its life was cut short by a bloodthirsty gardener next door, who made a point of slaying all birds who ventured within his bounds. This bird had a white head, neck, and wings, and was therefore a very conspicuous object on the lawn. Fieldfares and redwings visited the garden in hard winters for the sake of the holly berries, the winter of 1861-62 in particular was memorable for the hundreds which came to a large holly close to the house, and though fired at from a window, returned again and again. Those which were killed were found to be very good eating. It was that same winter, to the best of my recollection, that so many blackbirds, thrushes, and starlings, besides redwings and fieldfares, were found dead under the bushes, literally in heaps. A large square hole was dug, and the victims of the frost were wheeled off in a barrow by the children, and buried. In the spring of 1879, and again in October, a ring ouzel was observed on the lawn for a few days during its migration, and in the following January a coot was seen there in search of food. The missel thrushes built in the forks of the sycamores. Such birds as robins, hedge sparrows, wrens, and chaffinches were, of course, common. Numbers of greenfinches built in the elder hedge, and their cheerful note might be heard all the summer long. A pair of golden-crested wrens were often to be seen, but no nest was ever found. Great, blue, and cole tits were constant residents, all of them, the latter especially, coming in winter to feed from a marrow bone hung outside one of the windows. The summer migrants were perhaps the most interesting; these were the spotted flycatcher, redstart, willow wren, blackcap warbler, and garden warbler, etc. There were several pairs of flycatchers, one built every year on an ivy-covered acacia until it was blown down, another in a vine, and a third once on the hinge of an unused door. The redstarts generally built on the ivy-covered wall on the east side of the garden, but one year a pair made their nest in some ivy on the south side of the house, close to the street. The blackcaps and garden warblers built in the lilac hedge, and the willow wrens amongst the grass in the "Hollow." Swallows (*Hirundo rustica*) built under the eaves of some outbuildings, and the whole summer long circled over the garden, high in the air in fine weather, or up and down the lawn and over the bank into the Hollow when it was dull and cloudy. Swifts built in the towers of the Minster close by, and added their cheerful screams to the general chorus.

Having touched upon the botany and ornithology, I ought to say something of the entomology of the garden, but am only competent to do so in a general way. There were the ordinary sorts of butterflies—red admirals, peacocks, tortoiseshells, whites, and many moths, large and small, of which I do not know the names. Lady-birds were common, especially in spring, in the box edging to the gravel paths, and beetles of all kinds. On the banks of the "Hollow," in hot, dry weather, there were numbers of a small red insect, about one-eighth of an inch across, round, and the colour of vermilion. Wood gives a picture of it in "Common Objects of the Country," but no description. He calls it "Trombidium." We called it the red spider.

A squirrel lived in the larch trees; when one of them blew down its nest was found at the top. One other inhabitant was the Roman snail, (*Helix pomatia.*) About two dozen were imported from Kent, and lived for many years about the wall, but, I believe, never increased in numbers. I am told they are much scarcer in Kent now. The common garden snail (*Helix aspersa*) was to be found in hundreds, but was now and then effectually thinned by a bribe of 1d. the dozen, which the children received for destroying them in salt.

This interesting old garden is now in the hands of strangers, and, with the paddocks surrounding it, likely to be cut up into building plots, so it is to be feared the birds will be driven away and its character quite altered.

A. E. I.

THE MINERALS OF THE MIDLANDS.

BY C. J. WOODWARD, B.SC.

The following replies were received too late to be acknowledged in the May number:—

DERBYSHIRE.

Mr. A. H. Scott White, B.Sc., F.G.S., reference to an article in the

"High School Magazine" for Midsummer, 1878, on Derbyshire minerals.

GLOUCESTERSHIRE.

Mr. W. Lucy, F.G.S., promises a full and complete list of minerals.

SHROPSHIRE.

Professor Prestwich, M.A., F.R.S., list of minerals and reference to paper.

WARWICKSHIRE.

Mr. A. H. Atkins, B.Sc., reference to localities for minerals.

Mr. G. T. Cashmore, promises localities and other information.

WORCESTERSHIRE.

Dr. Harvey B. Holl, F.G.S., list of minerals of the Malvern Hills.

I may now proceed to sum up the information received respecting minerals of the different counties.

DERBYSHIRE.

SOME NOTES TAKEN FROM A PAPER ON "THE ECONOMIC GEOLOGY OF DERBYSHIRE," by MR. A. H. STOKES, F.G.S., H.M. INSPECTOR OF MINES.

Brown Hæmatite.—A little to the north-west of Hubberdale Mine, near Taddington, and also near Elton.

Limonite.—A field one mile north of Castleton, and to the east of Odin Lead Mine.

Brown Lead Ore—Linnets.—Near Elton and Newhaven. Called *linnets* from its linnet-like colour.

White Lead Ore—Cerussite.—A large quantity has been found near Brassington, also at Heyspots Mine, near Elton. Also found occasionally at Cabin Mine, Newhaven. The ore is sometimes called "Wheatstone," probably from its resemblance to wheat or rice.

Green Lead Ore—Pyromorphite.—Mines near Winster.

Phosgenite—Murio-carbonate of Lead.—Very scarce. Mr. Stokes has been able to obtain one small specimen. This was found in Meer Brook Sough Mine, Wirksworth.

Gypsum.—Chellaston, also in railway cutting between Trent and Loughborough.

Barytes.—In nearly all lead mines. The mineral is used for adulterating white lead. After being ground to fine powder it passes into settling troughs. When the troughs are partly filled with sediment the paste is removed and placed on hot stones. It is afterwards cut up into bricks, dried, and pressed into barrels like cement. For the finer quality the paste from the settling troughs is placed in lead vats and mixed with vitriol, kept warm by steam, previous to being dried.

Pyrites.—Large cubic crystals at Gregory Mine, near Ashover.

Blende. — Specimens can be obtained from the old hillocks, near Ashover and Hartington. An interesting variety, called *Ruby Blende*, is found crystallised on Limestone or Calc Spar. The crystals are small, and of a nearly transparent red colour.

Wad.—There are a number of mines near Elton working this mineral. At Wensley, many years ago, there was a furnace (now in ruins) in which black Wad was burnt. It was afterwards packed in barrels and sold to the Government as a black pigment for painting ships in the navy.

Copper Ore.—Ore not now worked. Specimens can be obtained from old hillocks at Ecton Mine, also at Cumberland Mine, Matlock Bath. *Malachite* has been met with at the Nursery Mine, between Hopton and Brassington.

Calcite.—Best specimens at Alport, Ashover, and Wirksworth. Colourless at lead mines of Nether Haddon, near Bakewell. Putty Hill Mine, near Monsal Dale Station, is solely worked for *Calc-spar*, which, after leaving the mine, is broken up, and then passed through crushers. It is sold for garden walks and other ornamental purposes.

Fluor Spar.—Worked for ornaments. After leaving the mine, the mineral is dried and then thoroughly saturated with melted resin to prevent it cracking. This facilitates the artist's work in turning and polishing. *Tigre Stone*, a scarce variety, consisting of a mixture of transparent fluor and opaque cream-coloured fluor.

Elaterite.—Only found in one locality, near Castleton. The best place is in Windy Knoll Quarry, near the bottom of Mam Tor, and within a few yards of the road leading from Chapel-en-le-Frith to Castleton.

Petroleum.—A large quantity of this mineral oil is yearly obtained from the Kilburn coal workings at Ridding's Colliery, near Alfreton. A sump is sunk at the bottom of the mine, and into this the oil finds its way. Some years, as much as 100 tons of oil have been obtained. It is sold for various lubricating purposes, and realises as much as £7 10s. per ton.

Rock Crystal.—Found in amygdaloid cavities of decomposing toadstone, near Buxton; also at Diamond Hill, near Miller's Dale Station.

Besides "Hall's Mineralogical Directory," I find that "A Manual of Mineralogy," by Gregg and Lettsom, Van Voorst, 1858, gives reference to British localities. Derbyshire localities, different from those already given, are

Anhydrite.—Aston-on-Trent.

Barytes.—Stalactites, with concretionary and radiating markings of rich brown in a field at Newhaven. *Cockscomb Barytes*, common in Derbyshire localities. *Hepatite*, an impure spar, emitting a fœtid odour on friction, occurs at Buxton, Eyam, and Matlock.

Melanterite.—Castleton.

Malachite.—Hopetown.

Chessylite.—Middleton, Hopetown, Wensley, and Matlock.

Anglesite.—Bromington Moor, near Eyam, and Crick Mine, near Wirksworth.

Mr. Stokes writes me that little dependence is to be placed on the printed lists of Derbyshire minerals, and refers to several deficiencies in Hall's list already given.

The article on Derbyshire minerals, in the "Nottingham High

School Magazine," closes with the following references to Derbyshire localities:—

"The following are a few good localities for minerals:—Cromford—various mines, especially the deserted workings near the Black Rocks. Matlock—at the old shafts and refuse heaps on Masson Hill, and at the back of the High Tor. The guide of the High Tor Grotto has always a large stock of good Derbyshire minerals on sale. The rocks near the mouth of the grotto afford specimens of amygdaloidal Toadstone. Many of the commoner minerals may be obtained at Crich Hill, near Whatstand-well. Along the road to Castleton from Miller's Dale, there is a close succession of old mines, all of which will repay a careful search."

METEOROLOGY OF THE MIDLANDS.

THE WEATHER OF MAY, 1881.

BY CLEMENT L. WRAGGE, F.R.G.S., F.M.S., ETC.

Marked atmospheric vagaries occurred; the month from the North Midlands being reported by our observers as "warm," and from the southern counties as "cold, except towards the very end." Temperature generally had a wide range; nocturnal radiation, after warm days, causing ground-frosts, very damaging (together with the deficiency of rainfall) to garden produce and vegetation. At Henley-in-Arden the rainfall was 1·131 less than the mean of 11 years; but on Axe Edge the total monthly amount was 4·200. An area of unusually high pressure—the highest recorded at Tuxford during the last 5 years—held over the country between the 7th and 12th, accompanied in "front and rear" by an increase of temperature; but oddly enough by an intermediate thermic fall, the reverse of the usual summer conditions of a high barometer. A trough rapidly approached on the 14th, and a deep cyclonic ring passed on the 16th, with a corresponding fall of temperature. After a narrow crest a secondary disturbance crossed on the 18th and 19th, thunder occurring in its rear at Buxton and other stations. The barometer again ran high on the 22nd and 31st; a depression, accompanied by thunderstorms, and bringing the "greatest fall" at many stations, intervening. An extraordinary anticyclonic heat wave closed the month, a maximum of 88·0 on the 31st being reported from Leicestershire. Extreme values from radiation instruments (solar) 140·2 on the 28th, (terrestrial) 9·5 on 11th, both reported by Mr. Browne from Leicester. Ozone appears to have been very plentiful, full amount (viz., 10) being registered by my observer at Oakamoor in the Churnet Valley on 14th, 17th, 18th, and 19th. At Buxton the mean daily amount was 6·4, and at Carmarthen the mean for the month was 6·0. At Hodsock 237 hours of bright sunshine were recorded. Solar halo at Oxford on 11th. Large group of sunspots observed at end of month. Mean sea temperature at Scarborough, 46·0. Violent thunderstorm, the most severe one during a period of 22 years, at Llandudno on 26th.

Notes by Observers.—*Burton.*—Corncrake heard, 5th; horse chestnut in full leaf, 5th. Hawthorn (a large display) in flower generally about 26th. Apple and other fruit blossom late, but abundant. *Alstonfield.*—First swift, 3rd; a few swallows, 8th; house martins, 13th; swifts in numbers, 19th; late arrival of house martin peculiar. *Nottingham.*—Oak out distinctly before ash; tremendous show of "May"

STATION.	OBSERVER.	RAINFALL. Total for M. In	Greatest fall in 24 hours. In.	Greatest fall in 24 hours. Date.	No. of rainy d.	TEMPERATURE. Greatest ht. Deg	Greatest ht. Date.	Greatest cd. Deg	Greatest cd. Date.
GLOUCESTERSHIRE.									
Strond	S. J Coley, Esq.	1·21	·45	17	9	74·0	2[illegible]	32·0	11
Cheltenham	R. Tyrer, Esq., B.A., F.M.S.	·91	·29	17	12	78·5	31	26·2	12
WILTSHIRE.									
Marlborough	Rev. T. A. Preston, M.A.	1·5[illegible]	·43	17	9	75·3	31	28·1	11
SHROPSHIRE.									
Woolstaston	Rev. E. D. Carr	2·15	·78	17	15	76·0	31	35·0	10
Stokesay	M. De La Touche	1·58	·43	17	14	80·0	31	26·2	11
More Rectory, Bishop's Castle	Rev. A. S. Male	1·63	·36	17	14	77·0	31	32·0	17
Cardington	Rev. Wm. Elliot	1·48	·58	17	13				
Dowles, near Bewdley	J. M. Downing, Esq.	·97	·32	18	8	75·0	28	19·0	11
WORCESTERSHIRE.									
West Malvern	A. H. Hartland, Esq.	1·62	·52	17	12	78·0	13	33·0	10
Evesham	T. J. Slatter, Esq., F.G.S.	1·46	·50	17	10	78·3	30	31·0	11
Pedmore	E. B. Marten, Esq.	1·48	·48	17	11	83·0	31	26·0	10
Stourbridge	Mr. I. Jefferies	1·55	·40	17	12	74·0	31	27·0	10
Dudley	Mr. C. Beale	1·69	·50	28	14	7[illegible]·0	31	34·0	10
STAFFORDSHIRE.									
Dennis, Stourbridge	C. Webb, Esq.	1·94	·70	26	12	81·0	31	28·0	11
Kinver	Rev. W. H. Bolton	1·21	·37	17	13	75·0	31	29·0	10
Walsall	N. K. Best, Esq.	1·58	·46	17	14	70·0	31	35·0	
Thorganby Villa, Wolverhampton	G. J. C. Broom, Esq.	1·50	·52	26	11				10
Lichfield	J. P. Roberts, Esq.	1·35	·41	25	10	84·0	31	26·0	10
Grammar School, Burton	C. U. Tripp, Esq., M.A.	1·30	·10	17	14	85·0	31	26·0	11
Wrottesley	E. Simpson, Esq.	1·56	·64	26	10	74·7	31	29·5	11
Heath House, near Cheadle	J. C. Philips, Esq., J.P.	2·01	·40	17	16	74·2	31	33·1	11
Oakamoor	Mr. E. E Kettle	1·85	·50	17	15	76·0	31	26·6	11
Alstonfield	Rev. W. H. Purchas	2·96	·79	17	10	79·4	28	23·[illegible]	11
WARWICKSHIRE.									
Henley-in-Arden	T. H. G. Newton, Esq.	1·35	·53	17	12	80·0	31	26·5	11
Park Hill, Kenilworth	T. G. Hawley, Esq.	1·06	·46	17	8	75·2	31	2[illegible]·0	11
Coundon, Coventry	Lieut.-Col. R. Caldicott	1·02	·34	17	11	74·0	30	31·0	10
Rugby School	Rev. T. N. Hutchinson	·88	·31	17	7	77·8	31	29·0	11
DERBYSHIRE.									
Buxton	E. J. Sykes, Esq., F.R.A.S.	4·3	1·12	17	14	75·2	31	27·7	11
Stony Middleton	Rev. U. Smith	1·81	·46	24	11	81·0	31	30·0	2
Fernslope, Belper	F. J. Jackson, Esq.	1·9[illegible]	·59	17	13	77·0	31	31·0	11
Spondon	J. T. Barber, Esq.	1·34	·37	17	11	72·7		28·0	
Linacre Reservoir	C. E. Jones, Esq.	2·24	1·04	26	11				
Duffield	W. Bland, Esq.	1·90	·33	26	16				
NOTTINGHAMSHIRE.									
Park Hill, Nottingham	H. F. Johnston, Esq	1·22	·37	26	13	76·0	31	35·0	10
Hodsock Priory, Worksop	H. Mellish, Esq., F.M.S.	1·75	·66	26	12	79·7	31	27·1	11
Tuxford	J. N. Dufty, Esq., F.G.S.	2·15	1·19	26	11	72·0	31	32·0	10
LEICESTERSHIRE.					9				
Loughborough	W. Berridge, Esq., F.M.S.	·96	·35	17	9	82·5	31	28·2	11
Syston	J. Hames, Esq.	1·06	·31	17	7	83·0	31	28·0	11
Town Museum, Leicester	M. Browne, Esq., F.Z.S.	·98	·28	17	9	77·9	31	29·1	11
Ashby Magna	Rev. Canon Willes	·91	·28	17	8	81·0	31		
Waltham-le-Wold	E. Ball, Esq.	1·06	·32		9	75·0	30	20·0	10
Dalby Hall	G. Jones, Esq.	·88	·25	26	9	88·0	31	23·0	11
Coston Rectory, Melton	Rev. A. M. Rendell	·74	·22	26		76·5	31	28·0	11
NORTHAMPTONSHIRE.					11				
Towcester	J. Webb, Esq.	1·40	·76	26	12	82·0	31	28·0	10
Castle Ashby	R. G. Scriven, Esq.	1·26	·85	17	11	77·0	31	31·0	10
Kettering	J. Wallis, Esq.	1·5[illegible]	·87	26	11	71·0	26 & 31	34·0	4 & 11
Althorp	C. S. Groom, Esq.	·92	·24	17		78·0	31	25·0	10
OXFORDSHIRE.					12				
Ratcliffe Observatory, Oxford	E. J. Stone, Esq., F.R.S.	1·36	·33	20		74·6	31	30·6	11
RUTLAND.					5				
Northfields, Stamford	W. H. Hayes, Esq.	·90	·60	26		78·0	31	25·0	11
Uppingham	Rev. G. H. Mullins, M.A.	·92	·318	26		81·9	31	31·4	4
OUTPOST STATIONS.									
Scaleby, Carlisle	R. A. Allison, Esq., F.M.S.	2·25	·43	5	14	77·5	29	31·0	10
Spital Cemetery, Carlisle	I. Cartmell, Esq.	2·04	·32	17	12	80·8	30	28·7	10
Scarborough	F. Shaw, Esq., F.M.S.	1·17	·60	21	12	71·3	13	33·5	11
Llandudno	J. Nicol, Esq., M.D., F.M.S.	3·74	1·61	26	13	71·8	31	38·0	11
Carmarthen	G. J. Hearder, Esq., M.D.	2·78	1·25	17	11	74·8	31	36·7	17
Altarnun, Cornwall	Rev. J. Power, M.A.	2·50	1·23	18	9	75·0	31	26·0	11
Sidmouth	W. F. Radford, Esq., M.D.	·89	·1[illegible]	17	11	78·2	31	34·6	11
Ventnor	J. Codling, Esq.	1·24	·36	18	10	74·5	31	38·0	11

N.B.—The Beacon Stoop observations for May will appear at foot in next number.

blossom. *Uppingham.*—Wood-sorrel, May 1st; Cuckoo-flower, 2nd, Bush Vetch, 12th; Stitchwort, 9th; Herb Robert, 10th; Bugle, 15th; Silverweed, 23rd; corncrake, 9th; cockchafer, 20th; meadow-brown butterfly, 8th; small white cabbage butterfly, 10th.

Hawthorn in full blossom at Fort William, N.B., first week of June, and truly magnificent display. The following meteorological values corrected will be of interest:—Ben Nevis, June 5th, maximum 41·2, minimum 28·4; 6th, maximum 31·6, minimum 26·9; 7th, maximum 30·4, minimum 23·2; 8th, maximum 26·6, minimum 21·5 for twenty-four hours ending nine a.m., snow lying $1\frac{1}{2}$ feet deep, and radiation thermometers hard frozen to the supports, the depth of winter prevailing on the Ben during the period indicated. Heavy sleet and snow on the mountain, June 26th. Very cold.—CLEMENT L. WRAGGE, Observer.

Reviews.

Guide to the Literature of Botany. By B. DAYDON JACKSON. Published for the Index Society by Longmans. 1881.

THIS is a thick volume of 626 pp., including the titles of over 9,000 works, classified under twenty heads. Its preparation must have involved immense labour on the part of the author, (the Secretary of the Linnæan Society,) but he has produced a work which is simply invaluable to every working Botanist. The list of local Floras, which occupies eighty pages, strikes us as being particularly useful.

W. J. H.

Report and Transactions of the Devonshire Association for the Advancement of Science, Literature, and Art. Vol. XI., 1879. 560 pp. W. BRENDON, Plymouth.

THE "Devonshire Association" resembles, in many points, our "Midland Union," except that it is composed of individuals and not of societies. Annual meetings of about three days' duration are held, and there are about 460 members who pay a half-guinea subscription. The volume before us deserves high praise. Besides the report and President's (Sir R. P. Collier) address, it includes the reports of seven committees appointed in former years to investigate the meteorology, folk-lore, barrows, &c., of Devonshire; and twenty-seven papers (ten geological) by various authors, all of which are valuable as adding to local knowledge. The association appears to have steadily advanced ever since its establishment at Exeter in 1862, and the names of the earnest workers now connected with it, Messrs. Vivian, Pengelley, T. M. Hall, R. N. Worth, &c., and the Rev. W. Harpley, (Hon. Sec.,) are an assurance of its continued success.

W. J. H.

Catalogue of the Library of the Museum of Practical Geology, Jermyn Street, London. 602 pp. Price 15s.

THIS valuable book is the work of Messrs. Henry White and T. W. Newton. It contains the titles of about 28,000 volumes, relating to the science of geology, arranged chiefly under the names of the respective authors. Although the library to which this book refers is not a public one, yet, as is stated in the preface, and as we can ourselves bear testimony, "every facility is given to persons who wish to consult it for scientific purposes." W. J. H.

Guide to the Geology of London and the Neighbourhood. By W. WHITAKER, B.A., F.G.S. (Geological Survey Memoir.) 3rd Ed., 94 pp., frontispiece. Price 1s. Stanford.

THE fact of a Geological Survey Memoir reaching a third edition is fair ground on which to congratulate the author. It is to be attributed to the clear style in which this little book is written, and to the moderation of the price.

In this new edition the deep well-borings are given with great care (well-sinkers are often wrong as to the chalk, gault, &c.) Mr. Whitaker confirms the view we have taken as to the possibly Triassic origin of the red marls from the bottom of the Crossness Well (Midland Naturalist, Vol. III., p. 189.) He writes, "Again at Crossness, we have beds which seem to me to be Triassic, although very high authorities have classed them as Old Red Sandstone : . . having the series unmistakably present in the Devonian type at Cheshunt and at Meux's Brewery (Oxford Street, London,) it would be strange indeed were it to occur in its wholly distinct Old Red type at Kentish town, between these two places, and at Crossness, not very many miles from the latter of them. I believe that no such thing is known to occur anywhere ; the two types of what is generally taken to be one great geological system being limited to separate districts, and not occurring together."

We earnestly recommend every country geologist to possess himself of a copy of this valuable little book. W. J. H.

Correspondence.

LEAFING OF OAK AND ASH.—In a lane leading from Perry Barr to Great Barr there are several trees of these species, (more than twelve in all,) planted by the road-side near together, in an open situation. On May 22nd the oaks had been in leaf for a week, while only the tips of the branches of the ash trees showed here and there a trace of green. W. B. GROVE.

FASCIATION IN MOSSES.—During the excursion of the Birmingham Natural History and Microscopical Society to Church Stretton, I found on a patch of *Hypnum palustre* in fruit, one specimen where two setæ or fruit-stalks were united for their whole length so closely that it was only by observing the two capsules at the summit that they could be distinguished from a single seta. This occurrence, which resembles, probably, what is called fasciation in Phanerogams, appears to be rare in the Mosses.—W. B. GROVE, June 6th.

CONCHOLOGY.—In May last I was pleased to find *Ancylus fluviatilis*, var. *gibbosa*, in a spring near Smethwick. I do not think it has been recorded in this district before. At Whitsuntide I spent a few very pleasant days shell-collecting in Yorkshire, with my friend Mr. William Nelson. Among other beautiful shells we found the very rare varieties *Limnæa peregra*, var. *albida*, near Askern, and *Clausilia rugosa*, var. *albida*, near Stapelton Park.—J. MADISON, Birmingham.

Note on a variety of *Gonopteryx Rhamni.*—My friend Mr. Dugdale recently captured near Oxford a hybernated specimen of the Brimstone Butterfly, presenting most extraordinary, if not unique, coloration, nearly half the upper wings being of a brilliant vermilion colour, the lower wings being also bordered with the same. At first it looked so artificial that a careful microscopical examination was made, and some scales were also spectroscopically examined, but no tampering with the insect had taken place. Professor Westwood read a paper on it before the Ashmolean Society, but made no suggestion as to the cause of the singular occurrence, of which no similar record appears to exist, the variety Cleopatra bearing no resemblance to it either in shape or colour of marking.—G. C. Druce, Oxford.

Ornithological Notes from Cumberland.—While spending a few days in the middle of May on the coast of Cumberland I got a nest with seven eggs of the Sheldrake. It was down a rabbit hole on some sand hills, about seven feet in, and contained seven eggs on a nest of down. Rock Doves breed in similar places, and I found two nests, the old birds flying out as I approached. I saw at a keeper's a tame female Buzzard; he had had it in his possession four years. Every year it lays two eggs, and last year a hen's egg was placed under it. It sat upon it, hatched it, and reared a young game cock. This year when I saw it, it was again sitting on a hen's egg. Barn Owls, Sparrow, Kestrel, and Merlin Hawks, Buzzards, and Long-eared Owls are all to be found in this district. I found several Oyster-catcher's eggs, laid in a hollow on the sand hills near the sea. Curlews may be seen daily feeding on the sea-shore. Whinchats, Wheatears, and Stonechats are all common. Cuckoos are very numerous.—H. G. Tomlinson, The Woodlands, Burton-on-Trent.

Botanical Notes from South Beds:—

Name.	Date.	Aspect.	Situation, &c.
Vicia Sepium	Apl. 4	W.	Hedge bank.
Scilla nutans	„ 18	N.W.	Wood, chalky soil.
Ranunculus acris	„ 26	Open	Meadow.
Cardamine pratensis	„ 28	„	„
Cerastium arvense	„ 29	W.	Edge of a field.
Saxifraga granulata	„ 30	Open	Moist meadow.
Veronica Chamædrys	May 5	W.	Hedge bank.
Polygala vulgaris	„ 10	S.E.	Dry bank, chalky soil.
Hieracium Pilosella	„ 12	W.	„ „
Prunella vulgaris	„ 14	„	Wood, on gravelly soil.
Cratægus Oxyacantha	„ 14	„	Hedge.
Geranium Robertianum	„ 21	„	Hedge bank. Several local observers give this as earliest date.

Oak trees were fairly covered with foliage on May 18th, but ash trees had only just commenced to expand their leaves. As a further illustration of the backwardness of this season, it may be mentioned that by the end of the third week in June the Chiltern Hills in South Beds are usually gay with Orchids, especially *Gymnadenia conopsea*, *O. ustulata*, and *O. pyramidalis*. This year, however, on June 19th, the first-mentioned were only just coming into blossom, and the two others were not to be seen.—J. S., Luton.

Gleanings.

The Darwin Medal.—The adjudicators appointed to consider the papers sent in for publication in the "Midland Naturalist" on the subject of Geology, during the year ending March 31st, 1881, have, by a majority of four to one, recommended the award of the first Darwin Medal to Edward Wilson, Esq., F.G.S., of Nottingham, for his paper on the "Permian Formation," now appearing in our pages. Further particulars will be given in the Report of the Council, to be published in our next number.

ENTOMOLOGICAL PRIZE.—No paper having been sent in, in competition for the prize offered by the President of the Union, Sir H. Wake, the offer has been very kindly renewed for another year. The subject is as before, "The Life History of any one Genus of Insects Indigenous to the Midlands," and the author must be a Member of one of the Societies in the Union.

THE BRITISH ASSOCIATION.—It is probable that at the York meeting invitations for 1883 will be presented from Oxford, Birmingham, and Leicester—the University town is considered to have the best chance.

SCIENCE IN ELEMENTARY SCHOOLS.—The Society of Arts has awarded Mr. W. Jerome Harrison, F.G.S., a Bronze Medal and Certificate of Merit on vellum for a paper by him describing the practical and experimental teaching of Domestic Economy, as now carried on in the Birmingham Board Schools.

MOUNTAIN METEOROLOGY.—The Editor of the meteorological department of this magazine, Mr. C. L. Wragge, now climbs daily to the top of Ben Nevis, (no slight undertaking,) while Mrs. Wragge observes at the foot of the mountain. Mr. Wragge has placed his fine set of instruments on the mountain-top, and has already made some remarkable observations. It is hoped that before the winter a permanent meteorological station will be erected on this, the highest point in the British Isles.

BUFFON'S SKUA.—Mr. J. N. Dufty records in the *Field*, (for June 25th,) the capture of this bird at Tuxford, Notts.

A VERY OLD BIRD.—The remains of a bird have lately been discovered in the Upper Jurassic (= Oolitic) Rocks of Western-North America; the oldest known bird of the Old World occurs in beds of about the same age—the *Solenhofen Stone* of Germany.

THE OLDEST FOSSIL TRIGONIA.—Dr. C. Barrois has discovered two new species of the shell *Trigonia*, in the Lower Lias (*angulatus* zone,) near Oviedo, in Spain. Previously this shell had not been found lower than the Middle Lias.

EFFECT OF GREAT COLD ON MAGNETS.—It has long been known that when a magnet is made red-hot it loses all its magnetic properties. Recent investigations prove that intense cold has a similar effect. In one case, a bar of steel, which had been magnetised at a temperature of 20° C., was found to lose seven-tenths of its magnetic intensity when placed in a freezing mixture which had a temperature of minus 60° C.

AEGOCERAS CATENATUM.—Under this name Dr. Wright figures and describes in the new volume of the Palæontographical Society an Ammonite, forwarded to him by Mr. W. J. Harrison, from the Lower Lias (*angulatus* zone) of Barrow-on-Soar. Although Barrow is at present the only British locality, we believe that this Ammonite is not really rare, but that it is usually mistaken for *Ammonites angulatus*, which it much resembles.

SIZE OF THE HEAD.—Dr. Beddoes and Mr. Tuckett (see *Proceedings of Bristol Naturalists' Society*) believe that there is evidence to show that the size of the human head in this country has been gradually diminishing during the last twenty-five years; they quote statements made by hatters in all parts of the kingdom in proof of this; one large hat-maker writes—"Fifteen years ago the usual sizes of hats in England were from $6\frac{3}{4}$ to $7\frac{3}{8}$, and even $7\frac{1}{2}$ was not uncommon; but now, if a $7\frac{3}{8}$ hat was wanted, we should have to make a block purposely."

Fossiliferous Bunter Quartzite Pebbles.—We have more than once mentioned the occurrence in the drift of the Midlands of quartzite pebbles, apparently derived from the Bunter pebble-beds, and containing some remarkable fossils, more especially *Orthis Budleighensis*, a brachiopod which also occurs in the stones of a pebble-bed in the Trias at Budleigh-Salterton, near Exmouth. Mr. A. H. Atkins, B.Sc., of King Edward's School, Birmingham, has lately found some good specimens of the same fossil in a precisely similar matrix—a reddish quartzite—in a true Bunter pebble-bed, at Kinver Edge, west of Stourbridge. No British rock is yet known which by its disintegration could have yielded these pebbles, at least no such rock has as yet been certainly identified. In Normandy and Brittany, however, this fossil (*O. Budleighensis*) occurs in just such a quartzite. A much larger collection of these pebbles with included fossils should be made, and as they are scattered all over the Midlands, either in the Bunter beds or in the drift, all readers of the "Midland Naturalist" are asked to help in the search, and to forward any which may contain fossils to our office. Under the name of "petrified kidneys," similar pebbles still pave the back streets of our large towns, and the broken heaps which are seen on the roadsides afford admirable opportunities for the search we recommend.

Reports of Societies.

BIRMINGHAM NATURAL HISTORY AND MICROSCOPICAL SOCIETY.—General Meeting, May 3rd.—Mr. Bagnall exhibited *Cincinnulus Trichomanis*, in fruit; *Lophocolea heterophylla*, *Mnium subglobosum*, *Polytrichum formosum*, and *Hypnum striatum*, from Kingsbury Wood; *Physcomitrium pyriforme*, in fruit, from drains near Seckington; and *Salix Hoffmanniana*, from Freasley. Mr. Blatch exhibited *Achenium humile*, from Salford Priors, and *Aneurus lævis*, from Bewdley Forest, both rare and new to the district. Mr. Grove exhibited *Peziza vesiculosa*, from Sutton. Mr. J. Morley exhibited *Draparnaldia plumosa*, from Sutton. Mr. Pickering exhibited a monœcious form of *Mercurialis perennis*. Professor T. W. Bridge read a paper on "Pasteur's Experiments on Bacteria," illustrated by diagrams. He described particularly the life history of *Bacillus anthrax*, and its connection with splenic fever. He also described the connection of Bacteria with fowl-cholera, and gave an account of the experiments which have been made with them, especially as to the mode by which the virulence of the disease is abated, when the organisms are cultivated for a certain length of time in artificial media. — May 31st. Biological Section. — Mr. W. R. Hughes, F.L.S., read a paper on *Bopyrus squillarum*, a small parasitic crustacean infesting the common prawn. Assuming, according to the laws of evolution, that the parasite and its host had been derived from a common progenitor, Mr. Hughes showed that the parasite—especially the female—had been worsted in its struggle for existence, owing to the peculiar position which it occupies within the carapace of the prawn. The embryo or nauplius stage of Bopyrus exhibits a much higher state of development than that of the adult animal. The paper was illustrated by a specimen and by some beautiful drawings by Miss Hadley. Professor Bridge gave a report on the Echinoderms, dredged by the society during the last two marine excursions to Arran and Falmouth. He stated that the class was exceedingly well represented, only a few genera being absent. The specimens had been admirably put up by

Mr. Ady, the Biological Demonstrator at the Mason College.—GENERAL MEETING, June 7th.—Mr. Haydon exhibited a section of Porphyrine. Mr. Bagnall exhibited *Mitrula paludosa*, a fungus new to Warwickshire; *Lithospermum officinale*, and other plants, from South Warwickshire. Mr. Grove exhibited the following fungi, from Sutton; *Stereum rugosum*, *Corticium læve*, *Polyporus vaporarius*, *P. adustus*, *P. annosus*, and *P. molluscus*, the last three new to the county.—BIOLOGICAL SECTION, June 14th.—Mr. A. W. Wills exhibited fresh-water Algæ, *Chantransia investiens* and *Leptothrix tinctoria*, from Penzance; and *Spirogyra inflata*, from Bangor; *Sarcina ventriculi*; alo a small insect, found in a Japanese parasol, which was referred to Professor Bridge for identification. Mr. R. W. Chase exhibited *Polystichum Lonchitis*, *Asplenium viride*, and *Lycopodium clavatum*, from Perthshire. Mr. H. W. Jones exhibited a cast-off shell of Arctic Stone Crab, *Lithodes arctica*. Mr. J. F. Goode exhibited *Spirogyra quinina* in conjugation. Mr. W. H. Wilkinson read a paper on "The Sea Gulls of Flamboro' Head," in which he gave an interesting account of the different species, their habits, and mode of living, &c. He also explained their structure and adaptation to the various functions they had to perform, in illustration of which he exhibited stuffed specimens of the Kittiwake, *(Larus tridactylus,)* the Black-headed Gull, *(Larus ridibundus.)* and the Herring Gull, *(Larus argentatus,)* all of which take their food on the wing. He also exhibited the Guillemot *(Uria troile)* and the Razor-bill, *(Alca torda,)* which obtain their prey by diving. A series of birds was also shown to illustrate the gradual evolution from the long toes without any membrane to the perfectly-webbed feet. He also called attention to the peculiar shape of the eggs of these sea birds, which he thought was a provision of nature to prevent their falling from the edge of the cliff on which they were laid, one end being so much smaller than the other that they could only roll in small circles. At the termination of the paper, which was listened to throughout with great attention, an animated discussion took place, in which the Chairman, Professor Bridge, Mr. Chase, and others took part.—MICROSCOPICAL GENERAL MEETING, June 21st.—The Secretary exhibited, on behalf of Mr. Winkley, two cases of insects, from Central America, offered for purchase to the society. Mr. Bagnall exhibited *Senecio squalidus*, from Oxford, sent by Mr. Sergeantson; *Scirpus multicaulis*, from near Coleshill; and *Myriophyllum alterniflorum*. Mr. Hughes exhibited the map prepared by Mr. Marshall of the district round Oban, to which the marine excursion is to be made, and read a letter from Mr. H. A. Fry, offering to pay one-fourth or one-third of the expenses of any associate who might be able to join the Oban Excursion.

BIRMINGHAM MICROSCOPISTS' AND NATURALISTS' UNION.—May 2nd. A paper was read by Mr. H. Insley, containing "Notes on the Burbury Street Clay Pit." The section shown in the pit was described, and rock fragments derived from the gravel and clay there exposed were shown, among which were fragments of Caradoc Sandstone, containing fossils; also, a very coarse-grained Basalt, in a perfect and in a decomposed state.—May 9th.—Microscopical and General Meeting.—Mr. Boland showed fifteen varieties of Land Shells, found on the banks of the Rushall Canal, among which was *Clausilia laminata*, this being a new locality for the shell. H. Insley, a number of fossil Corals from Mountain Limestone; Mr. Blay, a slab of ripple-marked Sandstone from Hamstead Colliery.—May 14th. An excursion to Stechford, Yardley, Marston Green. Larva of *Corethra plumicornis*, taken from pond near Sheldon; leaves of *Ranunculus repens* were infested with *Æcidium* (Cluster Cups;) *Arum maculatum*, of extra fine growth.—May 16th. A paper was read by Mr. Betteridge, "The Birds to be Seen in a Day's Ramble." The day in question was cold, with showers, and fewer birds than usual were seen. The number observed was forty-two. Mr. Boland exhibited *H. nemoralis*, var. *arenicola*.—May 23rd. Meeting devoted to Pond Life. Mr. Dunn exhibited *Volvox globator*; Mr. J. W. Neville, *Nitella translucens*; H. Insley, *Protococcus*; Mr. Boland, Ova of *L. peregra*, in course of hatching; Mr. J. Wykes, Pupa of *Corethra plumicornis*; Mr. Baxter, *Stephanoceros Eichhornii*. May 30th. Paper, "Notes on *Melicerta ringens*," by Mr. Dunn.

MIDLAND UNION OF NATURAL HISTORY SOCIETIES.

CHELTENHAM MEETING, JUNE 16TH AND 17TH.

On the invitation of the Cheltenham Natural Science Society the Annual Meeting of the Union this year was held under their auspices. Dr. T. Wright, F.R.S., the Medical Officer of Health for Cheltenham, and President of the Cheltenham Natural Science Society, is the President of the Union, and Mr. E. W. Badger (President of the Birmingham Natural History and Microscopical Society), and Colonel Basevi (Secretary of the Cheltenham Society), hon. secretaries. For the purposes of the local reception of the Union, a local committee was formed, consisting of the following; Dr. Wright (chairman), the Mayor of Cheltenham, the Baron de Ferrieres, M.P., Mr. J. T. Agg-Gardner, Major Barnard, F.L.S., Col. Blair, Rev. E. Cornford, M.A., Dr. G. B. Ferguson, M.A., Sir Brook-Kay, Bart., Dr. C. B. Ker, Rev. H. Kynaston, Dr. Julius Maier, Dr. Pullar, Dr. E. T. Wilson, and Messrs. C. G. Blatchley, F. Day, F.L.S., F.Z.S., H. J. Elwes, F.L.S., F.Z.S., T. Nelson Foster, H. A. James, M.A., A. Le Blanc, R. M. Lingwood, M.A., F. D. Longe, M.A., F.G.S., J. Middleton, R. O. Paterson, C. Pierson, G. W. Sadler, J. Walker, M.A. and G. B. Witts. Col. Basevi and Dr. Robert Smith, F.R.S., Edin., being the local hon. secretaries.

Most of these gentlemen took part in the proceedings, as did also the following: Professors Westwood (Oxford) and Wiltshire (London), Rev. Dr. Deane, F.G.S., Rev. H. W. Crosskey, F.G.S., Mr. W. R. Hughes, F.L.S., Mr. W. J. Morley, Mr. J. Morley, Mr. E. Tonks, B.C.L., Professor Bridge, Rev. C. Wilcocks, Dr. Hill, (Borough Analyst), Mr. J. Potts, Mr. and Mrs. Rabone, and Miss Osler (Birmingham), Mr. E. A. Walford, Mr. Samuel Stutterd (Banbury), Mr. C. Perks, Mr. J. Heron (Burton), Mr. B. Sturges Dodd (Nottingham), Rev. O. M. Feilden (Oswestry), Dr. Partridge, Mr. J. H. Rogers (Stroud), Mr. Egbert D. Hamel, Mr. Colin G. Campbell (Tamworth) Mr. E. Wethered (Bath), Mr. E. W. Phipps (Nailsworth), Mr. Horace Pearce, F.L.S. (Stourbridge), and many others.

The proceedings were commenced by the holding of the Council meeting at the Assembly Rooms, High Street, Cheltenham, at which nineteen delegates from the various societies were present. The meeting commenced at half-past twelve o'clock (June 16th,) and at a quarter-past one was adjourned till half-past two, in order to enable the delegates to accept the hospitality of Mr. Agg-Gardner, who most courteously invited a large company, including all the principal members of the Union who visited Cheltenham, to luncheon at the Plough Hotel.

The CHAIRMAN (Mr. Agg-Gardner) having given "The Queen," next proposed "Success to the Midland Union of Natural History Societies." He remarked that it would seem superfluous on his part to point out the objects of the Union, or even remark upon its merits or history. Its history in the past year and its future prospects would be dwelt upon by their excellent friend and president (Dr. Wright) at a later stage of the proceedings. He was sure his fellow townsmen were all exceedingly pleased the Union had selected Cheltenham for their meeting. He hoped that the town would in no way disappoint them, and that they would not look back with regret on their visit.

Dr. Wright, F.R.S., President of the Union and President of the Cheltenham Natural Science Society, whose name was coupled with the second toast, responded, and, after thanking the Chairman for his hospitality, pointed out briefly but forcibly and gracefully the advantages of such annual gatherings of Naturalists as that which had brought the company together from so many different counties. He concluded by proposing the health of "The Host," which was received with great cordiality.—Mr. Agg-Gardner acknowledged the toast, and proposed the healths of "the local Honorary Secretaries," (Colonel Basevi and Dr. W. R. Smith,) who both briefly responded, the latter concluding his remarks by proposing the "Corporation of Cheltenham," which the Mayor (Alderman Nash Skillicorne) acknowledged.

The Council meeting was then resumed, and was so protracted that the commencement of the Annual Meeting was greatly delayed. The business of the Council not being finished at four o'clock, the meeting was again adjourned until after the Annual Meeting.

THE ANNUAL MEETING.

A large number of members attended, including most of those named above, and many others. The President of the Union (Dr. Wright, F.R.S.) occupied the chair, and commenced the proceedings by reading the Address, printed in full at pages 145 to 159 of the "Midland Naturalist" for July.

It was unanimously resolved, on the motion of Professor Westwood, (Oxford,) "That the thanks of this meeting be given to the President (Dr. Thomas Wright, F.R.S.) for the able address now read, and that it be printed in the 'Midland Naturalist.'"

In consequence of indisposition, Dr. Wright then vacated the chair, which was taken by Mr. Edmund Tonks, B.C.L., (an ex-President of the Union,) and the formal business of the meeting was then transacted.

Mr. Edward W. Badger, one of the Honorary Secretaries, having read the minutes of the last annual meeting, held at Northampton, June 17th, 1880, it was resolved :—

(1.) "That the minutes be confirmed and signed."

Mr. Badger then read

THE COUNCIL'S REPORT.

The suggestion made by Mr. W. Jerome Harrison, F.G.S., at the last Annual Meeting that the Union should "offer a Gold Medal annually for some subject connected with the Natural History of the Midlands," was by resolution referred "to the Management Committee, with power to carry it into effect if they think fit." The Management Committee having devoted considerable thought and attention to the subject, ultimately worked out the details of a scheme for encouraging original research by Members of the Societies in the Union, which they communicated to all the Societies on the 30th of July last. As the Members are familiar with the details it is unnecessary for your Council to do more on this occasion than to put on record that the Committee decided to offer a prize annually, of the value of £10, to be called by the permission—very cordially granted—of Mr. Charles Darwin, F.R.S., 'The Darwin Prize,' for a paper indicating Original Research upon a Subject within the scope of your Societies, contributed by a Member for publication in the "Midland Naturalist" that Geology was selected as the subject for 1881; that contributions should be sent in on or before the 31st March last; and that a Committee of five should be chosen to adjudicate the prize, and declare the adjudication at the Annual Meeting. The Committee of Adjudicators consisted of

Dr. Thos. Wright, F.R.S.
Rev. Geo. Deane, D.Sc., M.A., F.G.S.
Professor Charles Lapworth, F.G.S.
Mr. J. J. Harris Teall, M.A., F.G.S., and
Mr. W. Jerome Harrison, F.G.S.,

the last named gentleman being requested to act as Secretary to the Committee. Your Council have received from Mr. Harrison the following report:—

"REPORT OF THE ADJUDICATORS.

(DRAWN UP BY THE SECRETARY, W. JEROME HARRISON, F.G.S.)

"Having very carefully considered the papers laid before them, the adjudicators have come to the decision, by a majority of four to one, that the paper by Edward Wilson, Esq., F.G.S., of Nottingham, on 'The Permian Formation in the North-east of England, with special reference to the physical conditions under which these rocks were formed,'* is deserving of the Darwin Medal for 1881, and they recommend that to Mr. Wilson the medal should be awarded.

"In Mr. Wilson's paper a full and admirably drawn up summary of our knowledge respecting an entire geological formation is presented to us; the materials are marshalled in a masterly manner, and the conclusions arrived at in a natural, clear, and definite way. But in addition, much of the evidence cited by the author is the result of his own original investigation, carried on for many years in the district to which he refers, and involving the application of almost every method of geological inquiry.

"The Adjudicators also note two other short but valuable papers by Mr. Wilson, on (1) 'Fossil Fish Remains from the Carboniferous Limestone of South Derbyshire,'† and (2) 'The Occurrence of Foraminifera in the Carboniferous Limestone of Derbyshire.'‡

"*June* 13*th*, 1881."

Your Council have pleasure in stating that, in accordance with this Report, they have awarded the Darwin Medal to Mr. Wilson, and congratulate that gentleman on his success.

The subjects for "The Darwin Prize" for the two years ensuing are, in 1882 Biology; in 1883 Archæology.

The ex-President of the Union, Sir Herewald Wake, Bart., on the 28th July last, authorised the Honorary Secretaries of the Union to offer in his name a Prize of Books, of the value of £5, for "the best Original Essay on the Life History of any one genus of Insects indigenous to the Midland Counties, written by a Member of one of the Societies in the Union." Your Council regret they have to announce that Sir Herewald Wake has received no response to his generous

* Mid. Nat. vol. iv., p. 97, &c. † Mid. Nat. vol. iii., p. 172.
‡ Mid. Nat. vol. iii., p. 220.

offer; but they are authorised to state that the offer is renewed for another year on the same terms as before, and they trust some of the many able Entomologists in the Union will worthily win the ex-President's prize before the next Annual Meeting.

During the year the following Societies have expressed a wish to join the Union, and your Council have to-day admitted them, namely, The Banburyshire Natural History Society, The Birmingham Microscopists' and Naturalists' Union, The Nottingham Working Men's Naturalists' Society, and The Oxfordshire Natural History Society. The only other change in the constitution of the Union during the year is the withdrawal of The Small Heath Literary and Scientific Society.

With the object of extending the usefulness of the Union by facilitating communications between the Societies of which it consists, your Council have collected some information relating to the Societies, and their Officers, which they feel assured will serve the purpose they have had in view.

[These particulars will be printed in full in future numbers of the "Midland Naturalist."]

In forwarding the series of questions to the various Societies which have elicited this information, a request was made by your Council for practical suggestions for increasing the usefulness of the Midland Union; to which the following responses have been made.

One Secretary writes:—"There seems to be a great want of reciprocity among the Members of the Union. A list of scientists who would be willing to visit and read papers before Societies other than their own might increase the usefulness of the Union, and add to the friendly intercourse of one Society with another—not *paid* lecturers, but those members who make Science their hobby, and are able and willing to enlighten the ignorance of their neighbours for the love of the cause."

Another Secretary writes:—"I think it would be worth while for all the Societies in the Union to exchange copies of their several Annual Reports or Transactions, as they appear from time to time; by so doing they would do much to promote the advancement of knowledge and of work in the Midlands. It is often of great importance to know something about the Natural History of other localities, to help the drawing of conclusions, and as some guide to the work of tracing the extent of any object; and this information is not usually found in Books of Natural History. Writers of papers, too, would not then be writing for the people of their own district only, but for the wider area of the Midland Counties at least. Valuable papers get printed, year after year, which we have never seen, and scarcely heard of, and yet the Societies that have published them are in the Midland Union. It is of the highest importance in working out the Natural History of the Midlands that each Society should possess the means of correlating their observations with the observations of the other Societies, and this can best be done by the distribution of each other's papers as they are published."

This suggestion is made by another Secretary:—"That the Union should offer more prizes for treatises of a more elementary kind than those for which the Darwin Prize is awarded, and to Members less than a certain age, say 23 or 25."

A fourth suggestion is:—"That the Annual Meeting of the Union, if held earlier in the week than Thursday, would be more generally convenient to many Members."

One Secretary makes this practical suggestion:—"That the Societies in the Union should all be urged to make the Annual Meeting of the Union one of their own fixtures, so as to ensure a larger attendance. This would have been done by my Society on the present occasion, but the matter was unfortunately overlooked till too late."

This suggestion has also been made:—"That Sectional Meetings for practical work should be held during the year by groups of neighbouring Societies, who might in this way render valuable help to each other."

The last suggestion the Council have to bring before your notice is the following:—"The Council of the Midland Union are no doubt aware that the Railway Companies issue return tickets to members of Fishing Clubs to various places at single fares. The Committee of my Society have made application to the Midland, London and North-Western, and Great Western Railway Companies for the same privilege, but have not been successful in any case. They therefore suggest that an application be made by the Council with such influential support as they may be able to command. As the privilege is granted to even single members of Fishing Clubs, it would be a great boon if members of Natural History Societies were able to follow their pursuits with the like advantages."

Reference was made in the last Report to the Science College munificently founded at Birmingham, and endowed by Sir Josiah Mason, Kt., then nearly completed. The College was opened on the 1st of October last, the Inaugural Address being delivered by Professor Huxley, F.R.S., the benevolent founder being present on the interesting occasion. The cost of the site and of the landed property with which it was endowed (yielding an annual income of about £3,700) was £110,000, and the cost of the College and the furnishing was £60,000 more. The opening of this Science College in the heart of the Midland Counties is of so much importance and interest to most of the Members of this Union, that your Council felt it would gratify many who are assembled at this meeting to have some particulars of the progress it has already made; and by the courtesy of the Chairman of the Trustees they are enabled to state that

During the 1st term there were 52 students.
,, 2nd ,, 41 ,,
,, 3rd ,, 74 ,,

The present Professors are as follows:—

Mathematics.—M. J. M. Hill, M.A. Lond., B.A. Cantab., Fellow of Univ. Coll., London.

Physics.—J. H. Poynting, M.A. Cantab., B.Sc. London, late Fellow of Trinity College, Cambridge.

Chemistry.—W. A. Tilden, D.Sc. Lond., F.R.S.

Biology.—T. W. Bridge, M.A. Cantab., F.L.S.

But in October next additional Professors, recently appointed, will commence their Lectures as follows:—

Physiology.—J. B. Haycraft, M.B.

Geology and Mineralogy.—Charles Lapworth, F.G.S.

Civil and Mechanical Engineering.—Robert H. Smith.

Latin and Greek.—N. Bodington, M.A. Oxon.

English Language and Literature.—Edward Arber, F.S.A., Hon. Fellow of King's Coll., London.

French.—Mons. Eugene Joel.

German.—Dr. Karl Dammann.

In order to render the College available to those who are occupied by business avocations during the day, cheap Evening Lectures were given from January to April last, the attendance of Students at which was as follows:—

Lectures on	Elementary Physiology,	28.	(Prof. Bridge.)
,,	Fuel	49.	(Prof. Tilden.)
,,	Magnetism and Electricity	29.	(Prof. Poynting.)

Your Council is glad to be able to announce that it is intended to continue these Lectures, which, so far, have been experimental, it being proposed that they shall run side by side with the day Lectures during the Session. Other subjects than those above stated may be lectured on by the present professors, in addition to those by the additional staff.

Mr. W. Jerome Harrison, F.G.S., a Member of the Union, and one of the editors of the "Midland Naturalist," whose appointment as Demonstrator of Science to the Birmingham Board Schools was mentioned in your Council's last report, is now successfully engaged in giving experimental lessons on science to 1,200 children attending the Birmingham Board Schools; Mechanics, or rather Elementary Natural Philosophy, is taught to the boys in the fifth and higher standards, and Domestic Economy to the girls; the latter subject being considered as the application of Chemistry and Physiology to the explanation of the phenomena of home life. These lessons are most popular with the children, and the Board is building a lecture-room and laboratory as a permanent centre for the work, and has lately resolved to appoint a First Assistant Demonstrator. At the same time the instruction in science of a large number of pupil-teachers is carried on in connection with the Science and Art department; a plan too is being matured by which the advantage of special courses of instruction at the Mason Science College will be offered to the adult teachers. Your Council gladly give publicity to these interesting particulars.

Invitations for next year's Meeting of the Union have been received from the Nottingham Literary and Philosophical Society, and the Nottingham Naturalists' Society, and your Council recommend that the Annual Meeting for 1882 be held at Nottingham, and that Mr. A. H. Scott-White, B. Sc., B.A., etc., be appointed one of your Honorary Secretaries. It will be necessary also to appoint another Honorary Secretary in place of Mr. Badger, who declines to be re-elected in consequence of increasing engagements. Mr. Badger has served the Union from its commencement to the present time.

The arrangements for the present meeting are so satisfactory that your Council feel they cannot too heartily express their approval or too warmly thank the gentlemen on whom the great labour of making them has devolved.

It was then unanimously resolved:—

(2) "That the Council's report be received, adopted, entered on the minutes, and printed in the 'Midland Naturalist.'"

(3) "That the Annual Meeting of the Union, in 1882, be held at Nottingham."

Mr. Egbert D. Hamel, the Treasurer, next read his statement of accounts, from which it appeared that the total receipts from 1878 to 1881 inclusive, had been £83 15s. 7d., (including £4 13s. 6d. special subscriptions to the Darwin Medal Die Fund.) and the total payments £45 19s. 9d., leaving a balance of £37 15s. 10d. in hand, and a small sum to be collected from societies in arrear, out of which the current year's expenses, the cost of the dies for the Darwin Medal, and the Darwin Prize would have to be paid.

It was resolved, (4) "That the Treasurer's accounts be received, adopted, and entered on the minutes."

The following resolutions were also unanimously agreed to :—

(5) "That the Thanks of this Meeting be given to Sir Herewald Wake, Bart., for his kindness in offering an Entomological Prize in the past year, and for renewing the offer for the coming year."

(6) "That the Thanks of this Meeting be given to the Officers for their services during the past year."

(7) "That Mr. E. D. Hamel be re-elected Treasurer, and that Mr. A. H. Scott-White, B.Sc., B.A., &c., and Mr. W. J. Harrison, F.G.S., be elected Hon. Secretaries."

(8) "That the best Thanks of this Meeting be given to the Officers and Members of the Cheltenham Natural Science Society for the admirable arrangements they have made for the present gathering."

(9) "That the Thanks of this Meeting be given to Mr. Edmund Tonks, B.C.L., for his able and courteous conduct in the chair."

The meeting of the Council was subsequently resumed, and the necessary business of the Union was transacted, including the appointment of the Management Committee, consisting of the following gentlemen :—

The President (Dr. Thomas Wright, F.R.S.,) the President elect, the Editors of the "Midland Naturalist," the Hon. Secs. of the Union, the Hon. Treasurer, Mr. F. T. Mott, F.R.G.S., Mr. E Tonks, B.C.L., Rev. Dr. Deane, Rev. H. W. Crosskey, F.G.S., Mr. A. W. Wills, Mr. Lawson Tait, Mr. W. R. Hughes, F.L.S., Mr. H. Pearce, F.L.S., Mr. W. B. Grove, B.A., Mr. James E. Bagnall, Mr. J. J. H. Teall, M.A., Mr. Edwin Smith, M.A., and Mr. B. Sturges Dodd.

THE CONVERSAZIONE.

In the evening, at the Assembly Rooms, there was one of the best entertainments of its kind held in the town for many years, and the display of so valuable and interesting a collection of treasures, in various departments of Arts and Sciences, could hardly fail to suggest a regret that a permanent or at least more frequent opportunity of such displays is not afforded in a town so richly endowed as Cheltenham. The whole suite of rooms was occupied. The vestibule had been fitted up as a reception room, under the direction of Messrs. Shirer and Haddon, who, both here and in the large room, showed some fine specimens of antique furniture and pottery, and made other appropriate additions to the decoration of the rooms. A number of foliage and flowering plants were also lent by Mr. Cypher, free of charge, and added much to the general effect. A room was set apart to microscopes, and other objects and instruments interesting to microscopists. The exhibitors in this class included the Rev. E. Cornford, Dr. Wilson, (who showed specimens of micro-photography,) Mr. Wethered, Mr. Potts, Mr. Morley, Col. Basevi, Dr. Partridge, Mr. Elliott, Mr. J. Rodgers, Mr. Musgrave, and Mr. E. D. Hamel. Some of these gentlemen were in constant attendance, and fine specimens of hydrozoa and other living objects were shown during the evening. Mr. Wheeler (London) also showed a large collection of microscopic objects. The microscopical display was a good and varied one, but inferior in extent to that made at former meetings of the Union, a matter of great regret, and which we hope to see remedied at all future meetings. Members of the societies owe it to the local committees to help them as much as possible; and the Cheltenham Society did not receive nearly so much help from distant societies as it deserved, for it did its part most admirably, and with a lavish expenditure of time, thought, and money which could not have been surpassed.

In an adjoining room Mr. Matthews, Mr. Fisher, (Stroud,) and Dr. Maier gave practical expositions of the wonders of the microphone and spectroscope, and experiments in colours, with electric discharges, in Crooke's and other vacuum tubes. It would be impossible to mention in detail the various objects contained in the large room. Among the more popular sources of amusement was the telephone, shown under the management of Mr. Holst, connecting the ball room with that in which the microscopes were shown, and by means of which an animated conversation was kept up. In Archæology, Mr. J. Middleton, Mr. Bowle Evans, and Mr. G. B. Witts were exhibitors, the latter showing an interesting series of flint implements collected on the Cotteswolds. Colonel Smythe contributed from the wonderful store of Indian and Moorish treasures he is known to possess a very interesting collection, including old jewellery and Indian fetishes and gods. Mr. J. O. Smith showed several cases of coins and tokens of all ages, and a most interesting case of local relics, including an old sacrificial knife, nearly unique in this country, and which was found some years ago near Stroud. Its blade is rimmed and inlaid with gold, and the bone handle is wound round with gold wire. In Botany, Major Barnard exhibited a fine collection of living plants from near Cheltenham, which deservedly attracted great attention; some models of edible fungi were shown by Mr. H. W. Marsden, of Gloucester, and a collection of algæ by Mr. Dodd, of Nottingham. In Conchology, Mr. J. T. Marshall filled a large table with selections from a collection known as one of the finest in the country; they proved one of the most popular contributions to the exhibition. Near these was a hamper of edible snails, (*Helix pomatia,*) sent by Mr. Jenkins, of Leckhampton, who also sent a pair of large fresh water shells found in the neighbourhood, and in the Geological section a good series of fossils from the lias and oolite formations. In Entomology and Ornithology Mr. H. W. Marsden, of Gloucester, was the largest contributor. He sent a fine case of exotic lepidoptera and larvæ, and a well-arranged collection of British butterflies; a remarkable case of birds and nests, and an instructive series of birds' eggs. The Rev. J. A. Carr (Shipton) also was an important exhibitor in both departments, his contributions being confined to specimens of rare insects and birds found in his own neighbourhood, and therefore very interesting to local visitors. Mr. E. Mockler, Dr. Pullar, (whose collection was very fine,) and Mr. T. White each gave valuable aid to a remarkably good department. The Geological specimens included echinoderms and brachiopods from the lower oolites; coral rock from the lower coral reef of the Cotteswolds, the finest *Nautilus striatus* known; and a fine specimen of *Stromopora concentrica* from the Wenlock limestone. The valuable collections of Dr. Wright and of the College Museum (through the kindness of Mr. C. Pierson) were largely drawn on in this division. Mr. F. D. Longe and Mr. Pearce (Stourbridge) were among the other exhibitors. In Physiology, Dr. Robert Smith contributed a valuable collection of apparatus. Among the miscellaneous articles exhibited Herr Jung showed some fine specimens of amber, exhibiting a small but perfect intrusion of the fly, under the microscope. A notice of the exhibition would not be complete without acknowledgment of the valuable collections of paintings, both oil and water, and of etchings, contributed. Among those who lent from their collections were, Dr. York, Dr. Wright, Capt. Rogers, Capt. J. M. Reid, Col. Blair, and Mr. W. Jones, F.S.A.; and Mr. Woodward sent a fine pen and ink etching of Lord Beaconsfield.

The general arrangements were excellently carried out. The stewards were—Dr. Wright, Mr. Agg-Gardner, Colonel Basevi, Mr.

Blatchley, Mr. H. A. James, Dr. Pullar, Dr. R. Smith, Mr. J. Walker, and Dr. Wilson. The company were received by the President, Mr. Blatchley, and Dr. W. R. Smith. Refreshments were served in the ante-room, which was suitably fitted up, and during the evening Mr. Pollock's band occupied the orchestra. So pleased were visitors with the exhibition, that the stewards induced the contributors to allow their contributions to remain a second night, which they almost unanimously did, Mr. Fisher coming again from Stroud especially to exhibit the wonders of his department.

EXCURSIONS.

Friday was devoted to excursions. Five had been arranged for, but the weather was very unsettled, and the number of the excursionists fewer than had been provided for. It was, therefore, determined to limit the excursions to two—one, which we may describe as the popular one, to Hayles Abbey, Sudeley and Winchcombe, and the other, confined to an invited party, to Mr. H. J. Elwes's seat at Preston, and to Cirencester (Corinium.)

Hayles Abbey, Winchcombe, and Sudeley.

This party, over sixty in number, was under the guidance of Dr. R. Smith and Mr. J. Middleton. The weather was showery, and it was thought better to drive direct to Hayles Abbey without dwelling upon the interesting points *en route.* The brakes drove through Bishop's Cleeve, (passing the old Tithe barn on the way,) Gotherington, and round the base of the hills to Hayles Abbey, where the visitors alighted to inspect the ruin so interesting to archæologists. The history of the Abbey and its architectural features, so far as they can be now traced in the old archways and remains, were very fully and interestingly explained by Mr. Middleton. The party returned to the vehicles and drove back to Winchcombe, where they found a substantial and very welcome luncheon awaiting them.

Winchcombe Church was visited after luncheon, and its details and architectural features explained by Mr. Middleton. He said the church was an interesting example of what was comparatively rare in England—a church built all at one time, from one design, and even now quite unaltered, except with regard to its furniture and fittings, the originals of which have all perished. The consequence was that the church had a less picturesque, but more harmonious appearance than the usual parish church, built at various periods. The style of the whole is late Perpendicular. Except the somewhat mutilated rood screen, nothing now remains of the old stalls or other fittings, with the exception also of a very rich and delicately carved organ case of 17th century work. The font and its cover are of about the same date, and so is a very handsome brass chandelier still hanging in the nave. There is a fine embroidered altar frontal, dating from the 16th century, and some interesting communion plate, viz., chalices of 1570 and 1677, patten 1686, and flagon 1709. There is also an oak alms box, with three locks, for the vicar and two churchwardens, according to the Injunctions of Edward VI., 1547.

From the Church the party, still under the guidance of Mr. Middleton, walked to Sudeley Castle, where they were received by Mr. and Mrs. Dent. The visitors were then conducted through the various rooms of the Castle, whose varied objects of interest were explained by Mrs. Dent, assisted by Mrs. Talbot, Mrs. Traill, and other ladies. A paper giving a short history of the Castle was read by Mr. Middleton, who also pointed out the various objects of interest in the chapel, where Mr. J. D. Smith played a voluntary on the chapel organ. As

Mr. Middleton truly said, Mrs. Dent's excellent book on "Sudeley and Winchcombe" leaves nothing that is new to be said on the subject, and Mr. Middleton contented himself with succinctly epitomising the facts there given. Mr. Middleton concluded his paper with the expression of a hope that Mr. and Mrs. Dent might have many years' happy enjoyment of the works they had so liberally and well carried out, a wish which was heartily endorsed by the visitors. The whole party were then entertained by Mr. and Mrs. Dent at tea, which they found most refreshing and welcome, and after thanking their host and hostess for their kindness, they returned to Winchcombe, and thence to Cheltenham. There was much rain during the day, but the party were fortunate in escaping without a wetting.

Cowley, Cirencester, and Preston.

The second excursion, conducted by Mr. Francis Day, F.L.S., was to Preston, near Cirencester, where Mr. H. J. Elwes, F.L.S., had invited a number of gentlemen to inspect his botanical and zoological collections.

While ascending Windlass Hill, the geological section of Leckhampton, so elaborately described on the previous day by Dr. Wright, was pointed out, but the view was soon obscured by clouds, and then shut out by a heavy downpour of rain. On arriving at the turning leading to the Seven Springs most of the party descended from the carriage to inspect what is commonly known as one of the sources of the Thames. Here the Churn, an affluent of that river, emerges from its rocky source, and meanders among the hills in the form of a pretty and well-stocked trout stream. Having returned to the carriage, the quaint old church of Cubberley was passed, and then Cowley, the seat of Mr. Richardson-Gardner, M.P.; Colesbourne, the residence of Mr. Elwes, sen.; and Rendcomb, that of the late Sir F. Goldsmid. Some edible snails were observed in the grass on the banks by the roadside, giving evidence of the success which had attended the introduction of these creatures, deemed by the Romans a luxury, and which have retained their hold on the Cotteswolds long after their legions have passed away. Before reaching Cirencester the presence of the elm, *Ulmus campestris*, likewise introduced by these people, afforded further evidence of their occupation of this part of the country.

A little after eleven, Cirencester, the Corinium of the Romans, situated on the Corin, now termed the Colne, was reached. Arriving in the town the fine parish church was passed; this was rebuilt between 1504 and 1522 on the site of a more ancient structure. On the outskirts of the town the remains of the Roman wall were still visible. A drive of rather over a mile brought the carriage to Mr. Elwes's house. Here the party met with a most kind and hospitable reception from their host and hostess, and at once repaired to the garden and greenhouses, where such an extensive and beautiful assortment of plants, collected from all parts of the globe, many being rare species, were found, that a mere enumeration of their names would be next to impossible. Now the party separated. Botanists to examine the flowers, ornithologists the extensive collection of birds, largely Asiatic, and cabinets of birds' eggs, the proceeds of years of patient toil. Entomologists experienced a treat in inspecting the moths and butterflies, and it was pointed out that so similar is the black moth *Epicopeia* to two India species of *Papilio*, that should the antennæ be destroyed it becomes impossible to discern to which the example belongs, whether in short it is a moth or a butterfly. When the time of departure arrived it was admitted by all that days of examination would be requisite to do justice to the splendid collections rendered so peculiarly interesting from having been personally collected by their scientific owner. All regretted that the time of year precluded the possibility of seeing Mr. Elwes's splendid collection of lilies in bloom, a collection perhaps unique in Great Britain, and which he has so magnificently illustrated and described in his splendid monograph on the *Liliaceæ*. On the return journey the rain descended in torrents, preventing an intended visit to the Corinium Museum at Cirencester, rich in Roman and Saxon antiquities, and which Mr. Christopher Bowly had most kindly consented to describe. But, weather notwithstanding, the party returned to Cheltenham well satisfied with the day's occupations.

THE MINERALS OF THE MIDLANDS.

BY C. J. WOODWARD, B.SC.

LIST OF THE MINERALS OF DERBYSHIRE.

Compiled by the Rev. J. M. Mello, M.A., F.G.S.

DIVISION I.

The Native Elements.

NAMES.	REMARKS.	CHIEF LOCALITIES.
Gold	Traces said to have been found at junction with Toadstone, in Bakewell and in Miller's Dale.	Bakewell. Miller's Dale.
Copper	Occasionally found in the lead mines	Carb. Limestone district.
Silver	Generally present in more or less quantity with Galena	Ditto.
Antimony ..	Occasionally present in lead ores.	Ditto.
Arsenic	Ditto	Ditto.
Bismuth ..	Found on analysis in some altered Clay	Tideswell Dale.
Sulphur ..	Said to have been found in old mine	Castleton.

DIVISION II.

Compounds of the Arsenoide and Thionide Elements.

Arsenides.

Sulphides.

Iron Pyrites ..	Common. Fine cubes in Limestone and Coal, also pyramids in Shale and Coal, also concretionary forms	General.
Marcasite ..	Common, fine crystals often in Limestone, Shale, and Coal ..	Castleton, Staveley, &c.
Chalcopyrites ..	Mining districts in Limestone ..	Matlock, &c.
Galena	Common in the Carb. Limestone, often in fine crystals; also found occasionally in Coal Measures	Matlock, Castleton, Winster, &c., &c.
Blende	Common. Occasionally present in Clay Ironstone nodules in Coal Measures	Matlock, Cromford, Winster, Ashover, &c. Castleton.
Zinc and Iron Marmatite ..	In Lead Veins	Matlock, &c.

DIVISION III.

Compounds of the Halogen Elements.

Fluorides.		
Fluor Spar ..	Common in the veins in Limestone. Colours, white, yellow, blue, &c.	Matlock, Castleton, Winster, Ashover, &c.
var. Blue John ..	Concretionary nodules and veins in Limestone	Castleton.
var. Earthy ..	Dark blue, very small crystals..	Cromford, &c.

DIVISION IV.

Compounds of Oxygen.

Oxides.		
Limonite ..	In the Limestone tract	Ashover, Stoney Middleton, &c.
Hæmatite ..	In Toadstone, occasionally in Limestone. Generally present as a stain in the grits, sandstone, &c.	Matlock, Ashover, Castleton, Miller's Dale, &c.
Magnetite ..	In the Toadstone (Dolerite.) Always present..	Matlock, Ashover, Miller's Dale, Winster, &c.
Lead Matlockite (oxy - chloride of Pb) ..	.. ..	Cromford.
Manganese, Wad.	Common. Earthy. Often as Dendritic stains	Matlock, Winster, Tideswell, Hartington, &c.
Quartz	Crystals. Occasionally large in Toadstone; also found in the Carb. Limestone. Present as pebbles and grains in sands, grits, shales, clay, &c. ..	Matlock, Buxton, Ashover, Castleton, Kinderscout, Derby, &c., &c.
Chalcedony ..	Occasionally in Toadstone ..	Matlock.
Jasper	Ditto	Matlock, &c.
Chert	Common in the Carb. Limestone	General.
Flint	In the Drift Gravels	S. Derbyshire.
Carbonates.		
Aragonite ..	.. ..	Matlock, Ashover, Chellaston.
Calcite	Common as veins in Limestone district, often finely crystallised, and in the Dolerites as a secondary product, and in cavities in Clay Ironstone nodules	Matlock, Ashover, Castleton. Miller's Dale, &c., &c.
Calc Tuff ..	Common about springs in Limestone districts	Matlock, Miller's Dale, &c.
Stalactitic ..	In Caves	Matlock, Castleton.
Chalybite ..	Common in Coal Measures as Clay Ironstone, concretionary nodules and bands, sometimes sparry; also in Limestone ..	E. Derbyshire, Matlock, &c.
Malachite ..	Earthy, and stains	Matlock, Middleton, &c.

Azurite, v. Chessylite	With Malachite	Ditto.
Cerussite ..	Often finely crystallised; also acicular	Matlock, Stoney Middleton, Ashover, Eyam.
Cromfordite ..	Murio-Carbonate of Lead ..	Cromford.
Calamine ..	Connected with the Lead Veins.	Matlock, Ashover, Cromford, Wirksworth, Castleton, &c.
Aurichalcite ..	.. ..	Matlock.
Dolomite ..	Generally as rock masses, either original or products of alterations of Carb. Limestone	Eastern boundary of Derbyshire, Whitwell, Bolsover, Matlock, Wirksworth.
Silicates.		
Orthoclase ..	Found as a constituent in some of the grits, also as rolled pebbles	Grit districts. Drifts of South Derbyshire.
Sanidine ..	Rolled pebbles	Drifts of S. Derb.
Kaolin	Said to occur in Potholes ..	Hartington.
Labradorite ..	Constituents of the Dolerites ..	Limestone district.
Mica	In grits, sandstones, shales ..	Coal Measures, Grit country of East Derby and North ditto.
Biotite ..	In the Dolerites	Matlock, Miller's Dale, Castleton, &c.
Hornblende ..	Ditto	
Pyroxene Augite	Ditto	
Viridite	Ditto	
Olivine	Ditto	
Chlorite ..	In the Dolerites	Limestone district.
Clay	Beds of various ages	General.
Smithsonite ..	In the Lead veins	Matlock, Ashover, Cromford, &c.
var. with Cadmium	Said to have been found.. ..	Matlock. (?)
Sulphates.		
Anglesite ..	Fine crystals in the Lead veins..	Eyam, Matlock, Cromford, Wirksworth, &c.
Witherite ..	Occasional. In Lead veins ..	Matlock, &c.
Stalactitic.. ..	Large masses often found ..	Youlgrave.
Massive ..	In connection with the Lead veins	Matlock, Castleton, Wirksworth, Ashover, &c.
Epsomite ..	Efflorescences on walls, &c. ..	Dolerite district.
Gypsum	Massive, thick beds	Chellaston.
,, var. Satin Spar ..	Fibrous	Chellaston, Matlock.
,, Selenite ..	.. ..	Chellaston.
,, Anhydrite..	.. ..	Chellaston.

Phosphates.

Pyromorphite	Small crystals in Lead veins ..	Matlock, Bonsall, Brassington, &c.

Arseniates.

Tamarite, with Malachite. Rare		Matlock.

DIVISION V.

Hydrocarbons.

Bitumen, var. Petroleum.	In some of the shales of Carboniferous Limestone and Yoredale Rocks..	Castleton, Stony Middleton, Cromford, &c.
,, ,, Elaterite..	Elastic Bitumen. Rare	Castleton.
,, ,, Asphaltum	Rods in Elaterite; also filling cavities in fossils, &c.	Castleton, Ashover, &c.
,, ,, Black Coal	In Coal Measures; also in Carboniferous Limestone	East Derbyshire, Combe's Dale.
,, ,, Cannel ..	.. ..	Clay Cross, Pinxton, Walton, &c.

Mr. Rooke Pennington, LL.B., F.G.S., in a recent letter to me gives also names of Minerals from Derbyshire. These are, however, included in the lists of Mr. Stokes and Mr. Mello.

MIGRATORY BIRDS.

NOTICE OF THE ARRIVAL OF MIGRATORY BIRDS IN NORTH OXON. IN THE SPRING OF 1881, WITH NOTES.

The first migrant I observed this year was on March 29th—a fine male Wheatear. It was singing from the top of a tall hedge when I first saw it, but soon went off on the fallow. This bird is by no means common here, and only visits us in early spring. and again in September. The next day I examined at Wyatt's, the Banbury bird-stuffer, a Spotted Crake, which was killed by flying against the telegraph wires at Banbury, on the 14th. This is also a spring and autumn migrant; it is, however, believed to have bred on the Cherwell. The date was, I believe, rather an early one. I did not hear the Chiffchaff till April 9th—very late—since then they have been plentiful, and are still in song. Willow Wrens appeared on the 18th. This is a very common species with us; I saw hard set eggs on May 23rd. Three Swallows were seen at Bodicote flying round some apple trees on the 17th, and on the same day I heard the Wryneck. On the 18th I noticed five or six Redstarts, they had evidently just arrived; also a Common Whitethroat. The Cuckoo was heard on the 23rd, about the average date. A Whinchat, I am told, was seen at the brick-pits, near Banbury, on the 25th. A few pairs of this bird may be found chiefly along the railway banks, but they are not very common. I did not come across the Yellow Wagtail till the 28th, when I saw one on the telegraph wires. Strange to say this is a very favourite perch of the bird, as also for the Whitethroat. On the 30th, a pair of Blackcaps appeared in the garden—the male in splendid song; doubtless they had arrived much earlier. They had a nest of five eggs by May 15th. May 1st, House Martins. These have been backward in nesting on account of the dry season and their not being able to find mud for building. The next day I saw a pair of Swifts; by the 23rd they had nests under the slates of the village chapel. I was fortunate enough to get quite close to a Reed Warbler early in the morning of the 5th, it is rather a rare species here. I also noticed two or three Sedge Warblers. On the 7th, the Garden Warbler was in song, and the next day Lesser Whitethroat; the latter bird probably arrived some time before. A Corncrake was caught on the 7th. I have sometimes noticed them by the last week in April. In my list of autumn and winter migrants, I have included the Common Sandpiper as only appearing in early autumn, but I find now that it appears quite frequently enough in spring to warrant its being considered a regular visitor at that season. It stays but a very short time. Two or three were noticed about the 5th, and several frequented Broughton Castle Moat for some days about the 8th. On the 16th, Spotted Flycatchers arrived; there were hard set eggs in the garden before the middle of June, and yesterday the young flew. Turtle Doves were first heard on the 19th. Tree Pipit I heard in full song on the 29th, from its actions I have no doubt it had a nest close by; it usually arrives by the middle of April. We do not often see Sand Martins just here. On the 22nd April I paid a visit to a nesting-place, but they had not then arrived. The Nightingale has become scarce in this district the last few years; it has been heard once or twice this year. This completes the list of those noticed this year. We have one or two more species —the Nightjar, Wood Wren, and Red-backed Shrike for instance; all uncommon. This year they have not been observed that I am aware of. A Whimbrel was shot at Thorpe Mandeville, Northants, on May 16th. A specimen was procured last spring also; but it can only rank as an accidental visitor.

Bodicote, Oxon., July 2nd, 1881. OLIVER V. APLIN.

THE PERMIAN FORMATION IN THE NORTH-EAST OF ENGLAND,

WITH SPECIAL REFERENCE TO THE PHYSICAL CONDITIONS UNDER WHICH THESE ROCKS WERE FORMED.

BY E. WILSON. F.G.S.

(Continued from page 124.)

MAGNESIAN LIMESTONE.

The most important member of the Permian rocks of the North-east of England is the Magnesian Limestone, using that term as a broad one to include all the rocks from the Upper Limestone of Durham and Brotherton Beds of Yorkshire, down to the Lower or compact Limestone of Durham inclusive.

In *Durham* the Magnesian Limestone consists of the following sub-divisions:—*(a)*

I.—*Lower Limestone* (=Compact Limestone of Sedgwick.)—Light-coloured, compact, crystalline, or concretionary limestone, *poorly fossiliferous*, (38 species;) estimated thickness, 200ft.

II.—*Middle Limestone* (=Shell and Cellular Limestone.)—Light-coloured, irregularly bedded, compact or crystalline limestone. When fossiliferous the Shell Limestone of Sedgwick and the Fossiliferous Limestone of King; when unfossiliferous, the Cellular Limestone of Sedgwick and the Pseudo-brecciated of King. The Shell Limestone is the most *highly fossiliferous* member of the series, yielding most of the characteristic fossils of the formation (120 species;) estimated thickness, 200ft.

III.—*Upper Limestone*.—This member consists of an upper portion, compact, vesicular oolitic, and thin-bedded yellow limestone, and a lower portion of light-coloured, compact, crystalline or concretionary, thick or thin, bedded limestone. This rock contains but *few fossils*, viz., *Axinus dubius*, *Myalina Hausmanni*, *Turbo helicinus*, *Clidophorus costatus*, some entomostraca and foraminifera, also several species of fish of the genera Palæoniscus and Acrolepis, which have been found at one or two places on the coast, associated with the remains of coniferous plants and calamites; estimated thickness, 250ft.

UPPER RED MARLS.

It appears somewhat doubtful whether these beds are represented in Durham. Mr. Kirkby has given them a thickness of 50ft. in that county.

At and near Middlesborough, on the south bank of the Tees, some years ago (1863) two boreholes were put down, which, after passing through between 1,100 and 1,200 of Triassic rocks, gave the following very interesting sections in what may be the uppermost beds of the Permian formation at that spot:—

	Ft.
Keuper Marls and Sandstones, with Beds of Rock Salt and Gypsum	1,175
Dolomitic Limestone, upper part of Permian Strata (Ramsay)	67
Gypsum, Rock Salt, and Marls, including 14ft. of Rock Salt...	27
	1,269

	Ft.
Keuper Marls, &c.	1,190
Limestone and Red Sandstone ...	15
Rock Salt	99
Limestone with Rock Salt	7
	1,311

Prof. Ramsay (*b*) quotes the former of these sections as evidence of the occurrence of beds of Rock Salt in the Permian series of this country. I suppose Prof. Ramsay has satisfied himself of the Permian

(a) See Synopsis of the Geology of Durham and part of Northumberland, by Messr. Rd. Howse and J. W. Kirkby, 1863, to whom I am chiefly indebted for the information here given.

(b) Presidential Address to British Association, 1880, by A. C. Ramsay, LL.D., F.R.S.

character of the "Dolomitic Limestone," from actual examination of the cores, and that we may accept his statement on this point. Not having seen these cores myself, I cannot express a decided opinion thereon. *A priori*, however, there would appear to be a much greater probability of these beds of Rock Salt, Gypsum, and (?) Limestone, belonging to the overlying Salt bearing and Gypsiferous Keuper Marls than to the Permian Rocks.

In *South Yorkshire* the Magnesian Limestone consists of the following subdivisions :—*(a)*

Lower Magnesian Limestone consisting of :—

I.—*Lower Limestone.*—Light coloured, thick or thin bedded, oolitic or crystalline Limestone with thin marl partings, occasionally ripple marked. Mr. Kirkby describes *thirty-one species of fossils* from these beds. The fewness of the species is, to a certain extent, made up by number of individuals. Some of the beds are almost entirely composed of comminuted polyzoa. Only eleven of the thirty-one species or one-third are common to the compact Limestone (the lowest division of the Magnesian Limestone) of Durham, though all the species but two of this Lower Limestone of Yorkshire are found in the middle division (viz., the Shell Limestone) in Durham. Estimated thickness, 120ft.

II.—*Small Grained Dolomite.*—Light coloured crystalline or compact Limestone, with thin clay partings, irregularly stratified and apparently extensively false bedded. This rock is practically *unfossiliferous.* Estimated thickness, 200ft. It comes above the Lower Limestone.

Middle Marls.—Variously coloured marls, and soft sandstones, with thin seams of gypsum. These marls are very fluctuating in their distribution. According to Sedgwick they have not been found in the Magnesian Limestone north of the Wharfe; and south of that river they are also sometimes absent, in which case the Upper Limestone (Brotherton Beds) rest directly on the Lower Magnesian Limestone, as for instance, in the neighbourhood of Tadcaster. *(b)* Thickness, 50ft. to 30ft. or less.

Upper Limestone or Brotherton Beds.—Thinly bedded Limestones, white or grey, red or yellow in colour, containing little or no magnesia, and with thin marl partings, containing ripple marks and sun cracks. *The fossils are limited to a very few species*, viz., Myalina Hausmanni, Axinus dubius, and Acanthocladia anceps. Thickness, 30ft. to 120ft.

Upper Permian Marls.—This is a thin and fluctuating deposit in Yorkshire. It consists of beds of similar lithological character to the Middle Marls. It has but a small surface extension, being very generally overlapped by Triassic Rocks. Its maximum known thickness is 50ft.

(a) Notes on the Permian Rocks of South Yorkshire, and on their palæontological relations, by J. W. Kirkby. Q.J.G.S., vol. xvii., p. 287.

(b) The Permian and Triassic Rocks about Tadcaster. Mem. Geol. Survey see Map 93 S.W.

In *Nottinghamshire* and *Lincolnshire* the Magnesian Limestone series consist of the following subdivisions:—(a)

Lower Magnesian Limestone.—The rocks of this series vary much in character. Some of the beds are of a pale yellow colour and coarsely crystalline; others are white or reddish and finely grained, flaggy or thick bedded, sometimes false bedded, occasionally cherty or pseudo-brecciated. Ordinarily this rock is a true dolomite. Sometimes, however, it contains a large amount of sedimentary material in the form of sand, seams of micaceous marl, and even bands of grit and conglomerate. I observe that this feature is more especially characteristic of the formation in its *westerly* limits. At Mansfield, this rock locally loses its character of a true dolomite, and becomes intermixed with siliceous particles in proportions up to fifty per cent. This arenaceous dolomite yields the valuable and well known white and red "*Sandstones*" of Mansfield. These sandstones probably occur as large lenticular masses, 60ft. thick or more at their maximum, surrounded on all sides by dolomitic Limestone. At Shireoaks Colliery, on the northern borders of the county, the Lower Limestone proved to be 56ft. in thickness; between Worksop and Mansfield the thickness of the Limestone is not certainly known, but appears to lie between 70ft. and 80ft; 65ft. were passed through in Langwith Colliery, and from 50ft. to 60ft. of this rock are exposed in the craggy sides of the picturesque ravines, known as Creswell Crags; south of Mansfield, in the Leen valley district, the Lower Limestone has an average thickness of about 30ft., *e.g.*, at New Watnall Colliery it was only 23ft.; at Kimberley, Hempshill, and Newcastle Collieries, 27ft.; and at Cinderhill and Bestwood Collieries, 30ft.

The Lower Magnesian Limestone dies out along a line drawn from Radford to Strelley to the west of Nottingham. Along this line the Limestone consists of impure sandy and pebbly flagstones. At Bobber Mill (Radford) during the progress of the Leen Valley Sewage Works, I noticed the dying out Limestone gradually pass, in the last 200 yards of its range, from an ordinary crystalline yellow dolomite into a grit, and from this into a coarsely brecciated rock, an evident marginal deposit. The Lower Magnesian Limestone at its southern termination is evidently very much attenuated, apparently owing, not to subsequent denudation, but to the coal measures rising up from beneath the Limestone to form a land margin on the south. Hence the Limestone forms no escarpment along its south boundary. As a rule this rock is destitute of visible traces of organic remains, and when these do occur they are confined to a few thin beds, and are generally in the form of hollow casts or moulds of a very few species of mollusca, chiefly *Axinus* and *Myalina*. At South Scarle the Lower Magnesian Limestone is a cream-coloured, fine-grained, fossiliferous Limestone, 26ft. in thickness.

(a) Geology of parts of Notts and Deryshire. Mem. Geol. Survey., W. T. Aveline, F.G.S. Geology of the country around Nottingham. Ditto, 2nd Ed., 1880.

Middle Permian Marls.—Purplish red marls, with variable bands of hard calcareous and soft mottled sandstone, showing annelid tracks and ripple marks. As a rule these beds are not more than 20ft. or 30ft. in thickness, but at Shireoaks Colliery 50ft. were passed through. The Middle Marls rest somewhat irregularly on the Lower Limestone, except where occasionally overlapped by the Lower Bunter Sandstone, as for instance near Mansfield, these beds stretch as a narrow but continuous band through the county as far south as the Two Mile Houses west of Basford, near Nottingham. At South Scarle the Middle Permian Marls proved to be no less than 140ft. in thickness.

Upper Magnesian Limestone.—This rock only exists in a very attenuated form (20ft. or less) in North Notts, and dies out southwards near Worksop. It has the same lithological characters as in South Yorkshire, and contains similar fossil remains of *a very few species* of mollusca, viz., *Myalina Hausmanni*, *Axinus truncatus*, and *A. Schlotheimi.* At South Scarle this rock was 40ft. 6in. thick.

Upper Permian Marls.—A series of red and variegated Marls, that are only found at one or two places in North Notts, intervening between the Upper Magnesian Limestone and the New Red Sandstone. They appear to thicken out under the Triassic Rocks on the south-east, for some 80ft. or 100ft. of Marls, representing this series, were passed through in the South Scarle boring.

To be continued.

THE FLORA OF WARWICKSHIRE.

AN ACCOUNT OF THE FLOWERING PLANTS AND FERNS OF THE COUNTY OF WARWICK.

BY JAMES E. BAGNALL.

(Continued from page 129.)

CRUCIFERÆ (continued.)

NASTURTIUM.

N. officinale, *Brown.* *Water-cress.*
Native: In ponds, ditches, and streams. Common. June to August. Throughout the whole area.
The var. *Sii folium*, Reich., I have collected near Knowle Railway Station, Bradnock's Marsh, and near Billesley Hall. This does not seem to be more than a luxuriant state of var. *a.*

N. sylvestre, *Brown.* *Creeping Yellow Cress.*
Native: In ditches and pools. Rare. June.
I. Sutton, *Freeman, Phyt.*, *i.*, 262; "38, Warwickshire," *Bree, Cat. Top. Bot.*
I have never met with this plant in the county. *N. palustre* did occur in Sutton Park, and is not mentioned by Freeman; possibly mistaken for *sylvestre.*

N. palustre, *DC.* *Marsh Yellow Cress.*
Native: In wet places and near pools. Local. July.
I. Rotton Park Reservoir, *W. B. Grove.* Shores of Coleshill Pool; Sutton Park, sparingly, 1876.
II. (*Sisymbrium terrestre,*) in ditches, Oversley Mill, *Purt.*, i., 307; Bagington Bridge, near the race stand, *Perry*, 1817; Shrewley Pool, muddy places in the Avon, *Y. and B.;* Fern Hill! Stoneleigh, Kenilworth! *H. B.;* moist meadows, Brown's Over, Rugby, *H. W. T.;* Chadshunt, Kineton, *Bolton King.*

N. amphibium, *Brown.* *Great Yellow Cress.*
Native: In rivers, pools, and ditches. Locally common. June to August.
I. Curdworth Bridge, Forge Mills, Marston Green, &c.
II. Rowington Canal, Guy's Cliff, Stratford-on-Avon, Binton, &c.
Armoracia amphibia, Bab. Man.

ARMORACIA.

A. rusticana, *Rupp.* *Horse-radish.*
Alien: On river banks and waste places. Rare in the pseudo-wild state. May, June.
I. Old clay pits, near Erdington; Water Orton, on banks near the village.
II. *Cochlearia Armoracia*, on the River Arrow near Oversley Bridge! *Purt.*, i., 298; below Hatton-on-Avon, *Y. and B.*; osier beds, Guy's Cliff; Myton; Hatton Rock, *H. B.*

DRABA.

D. verna, *Linn.* *Whitlow Grass.*
Native: Walls, heathy waysides, &c. Locally common. March to May.
I. Sutton Park, Coleshill Heath, Great Packington, Baddesley Clinton, &c.
II. Whitnash! Chesterton! *Y. and B.*; Whatcote, *Rev. J. Gorle;* Abbott's Salford! *Rev. J. C.*; Harbury! Kingswood! &c.
Var. *b. brachycarpa.*
On thatched roofs and old walls. Rare.
I. Abundant on the thatch of an old shed near Bedlams End, 1874.
II. Old wall at Kenilworth, *Dr. Baker;* Lias walls, Harbury village, 1874.

D. verna, var. *inflata.*
Peaty grounds, the Pleasaunce, Kenilworth, *Mrs. A. Russell*, in *Herb Carroll*, *Brit. Mus.*, 1874.

ALYSSUM.

A. incanum. *Linn.*
Casual: In corn and other cultivated fields. Rare. June.
I. Abundant in a cornfield, Boldmir, near Sutton, 1874; railway banks, Sutton Park, 1877.
II. In a field at Emscote, near Warwick. *H. B.*

CAMELINA.

C. sativa, *Crantz.* *Gold of Pleasure.*
Casual: On railway banks. Rare. June.
Var. *A. fœtida*, *Fries.*
I. Railway banks, Sutton Park, 1877-78.
Var. *b. sylvestris.*
II. Cornfields near Fern Hill Wood, *H. B.*
In both localities a plant of uncertain occurrence.

THLASPI.

T. arvense, *Linn.* *Penny Cress.*
Colonist: On arable land and waysides in marly soils. Local. May, June.
I. (*Thlaspi Dioscorides,*) Kingsbury, *Ray. Cat.*, 1672; field by roadside leading from Meriden to Stonebridge, *Freeman, Phyt.* i., 262; waysides near Meriden Marsh, 1880.
II. Saltisford, Warwick, *Perry;* Alne Hills! Salford! *Purt.*, i., 298; Harboro' Magna, *Rev. A. B.;* Frankton, *R. S. R.*, 1872; Chesterton and Moreton Morrell, *H. B.;* Lighthorne, *Bolton King;* Brandon, Offchurch, Birdingbury, Compton Verney, Bidford, Billesley.

IBERIS.

I. amara, *Linn.* *Bitter Candy Tuft.*
Casual: On arable land. Rare. July.
II. Field between Stratford and Bishopton, *Herb. Perry;* in a ditch at Exhall, (near Coventry,) *T. Kirk, Phyt.*, ii., 769.

TEESDALIA.

T. nudicaulis, *Brown.* *Shepherd's Cress.*
Native: On banks and heathy footways. Very rare. May.
I. By the side of the road near Packington! *Bot. Guide*, ii., 635; Oscott College Grounds, abundant! *Rev. J. C.;* between Packington and Coleshill! *Bree., Mag. Nat. Hist.*, iii., 165; Old Chester Road; banks, Marston Green.
II. Sandstone rock, Milverton, *Perry;* Hill Morton Road, near Rugby. *R. S. R.*

CAPSELLA.

C. Bursa-pastoris, *DC.* *Shepherd's Purse.*
Native: In fields, on banks, waysides, &c. Common. March to November.
A very abundant and variable plant. Two well-marked forms occur; (1) with entire leaves, (2) with pinnatifid leaves. Both equally common.

LEPIDIUM.

L. ruderale, *Linn.* *Narrow-leaved Pepperwort.*
Denizen: In cultivated fields and waste places. Rare. June to September.
II. Waste places at Knowle Hill, Kenilworth, introduced with skins, *H. B.*; in a rick-yard at Kenilworth.

L. campestre, *Brown.* *Mithridate Pepperwort.*
Native: In fields and on waysides. Rather common. June, July.
I. Castle Bromwich, *Ick. Anal., 1837;* Sutton Park, Hartshill, Knowle, &c.
II. Bidford, Salford, Billesley, Prince Thorpe, &c.
Thinly but widely spread over the whole county.

L. Smithii, *Hook.* *Smooth Field Pepperwort.*
Native: On heathy waysides. Rare. June, July.
I. Balsall Common, *Tyler*; near Sutton Park, *W. B. Grove*; thinly spread on heathy waysides from Coleshill to Atherstone.
II. Abbott's Salford, *Rev. J. C.*

L. Draba, *Linn.* *Whitlow Pepperwort.*
Casual: On the borders of fields. Very rare. June.
I. Abundant on the border of a field near Bromford Forge, where it had been established for many years, 1878.

SENEBIERA.

S. Coronopus, *Poir.* *Swine's Cress.*

Native: On waysides and in fields. Locally common. June, July.

I. Hampton-in-Arden, near Bradnock's Marsh.

II. Harboro' Magna, *Rev. A. B.*; Burton Dassett, *Y. and B.*; Warwick Canal bank! *H. B.*; Abbott's Salford, *Rev. J. C.*; Ipsley! *S. J. Slatter*, abundant; Blackwell, Honington, Tredington, *Newb.*; Princethorpe, Offchurch, Binton, Billesley, Coldcomfort.

S. didyma, *Pers.*, occurs as a garden weed about Myton, *H. B.*; but has no claim to a place in the flora.

RESEDACEÆ.

RESEDA.

R. lutea, *Linn.* *Wild Mignonette.*

Native: Waste ground and road sides. Rare. May.

II. Near Rugby, *Rev. A. B.*; on the Leamington railway bank, near Rugby, *R. S. R.*

A casual weed, having no claim to be considered as established in the county.

R. Luteola, *Linn.* *Weld, or Dyer's Rocket.*

Native: Waste ground and road sides. Local. June to August.

I. Hill near Sutton; Knowle; railway banks, Sutton Park.

II. Salford, *Purt.*, i., 229; Tachbrook, *Y. and B.*; Emscote, *Perry, Flo.*, p. 85; Shipston-on-Stour, road from Stratford! *Newb.*; near Little Lawford Mill! *R. S. R.*; Chesterton, *Bolton King*; borders of Oakley Wood; Edge Hill, near Radford, 1877; near Luddington; marly fields, near Bidford; Banbury Road, near Stratford-on-Avon.

R. suffruticulosa, *Linn.* *Shrubby Mignonette.*

Casual: In arable land and waste places. Rare. July.

II. Harboro' Magna, *Rev. A. B.*; several specimens in a potato plot near Harboro' Magna, *R. S. R.*, 1874. "On the ground from which 8ft. or 10ft. of surface soil had been removed at the new waterworks, Coventry," *T. Kirk, Phyt.*, ii., 769. Var. *b. alba* is also found as a garden weed about Myton, *H.B.* Both these are mere remains or escapes from cultivation.

CISTACEÆ.

HELIANTHEMUM.

H. vulgare. *Gaert.* *Rock Rose.*

Native: In woods and on banks, in marly and calcareous soils. Local. June to August.

II. Between Warwick and Hatton, *Perry*, 1817; Chesterton! Fullbrook, *Y. and B.*; Abbott's Salford! *Rev. J. C.*; near Chesterton wood, *Bolton King*; near Rosehall, Exhall; Oversley Wood; Wixford; Billesley.

VIOLACEÆ.

VIOLA.

V. palustris, *Linn.* *Marsh Violet.*

Native: In marshes and bogs. Locally common. April to June.

I. Bog at Coleshill Pool! *Bree, Purt.*, ii. 415: Hill Wood, near Sutton; Sutton Park, very abundant; Trickley coppice and New park Middleton; Plant's brook, Minworth; Coleshill pool and bog; bog at Hill Bickenhill.

II. Allesley; marshy places in Haywoods.

The seeds are produced principally by the apetalous flowers which may be found as late as October.

V. odorata, *Linn.* *Sweet Violet.*
Native: In woods and on banks in old lanes. Locally common. February to April.
Var. *a. violacea.*
I. Lane from Sutton to Middleton; lanes about Sheldon, Elmdon, Stonebridge, Knowle, Shirley Heath, Wishaw.
II. Rowington, Sherbourne, Holywell, near Claverdon, Corley, &c.
Var. *b. lilacea.* More rare.
II. Leamington and Levenhall, Warwick, *Herb.*, *Perry;* lane near Rowington Church.
Var. *c. alba.*
I. Plant's Brook, near Minworth.
II. Saltisford, Warwick, *Perry*, *F. C.*, p. 20; Barby Village, near Rugby, *R. S. R.;* lane near Rowington Church; Holywell, near Claverdon.
Probably native in some of the old lanes, but a mere escape in many other localities.

V. hirta, *Linn.* *Hairy Violet.*
Native: In woods and on banks, in marly and calcareous soils. Local. April, May.
I. Sheldon, 1835, *Rev. J. Gorle;* near Anstey, *Rev. A. Blox.* (MS. note in Purton's Flora.) I have never seen it there, or in any district in the Tame Basin.
II. Bidford! Birdingbury, *Bree. Mag. Nat. Hist.*, iii., 163; Fosseway, *Y. and B.;* common at Harboro' Magna, *Rev. A. B.;* Honington, Tredington, *Newb.;* common about Chadshunt, *Bolton King.* Hatton Rock, near Hampton Lucy; lanes between Warwick and Sherbourne, near Kineton; abundant in Chesterton Wood, Drayton Bushes, and lanes between Exhall and Bidford.
Var. *alba*, Chadshunt, *Bolton King.*
A form approaching *V. permixta* occurs in a spinney near Stratford-on-Avon, in the Warwick Road.

V. hirta is not recorded from the county by either Purton or Perry, although abundant in the districts worked by those botanists.

V. sylvatica, *Fries.* *Wood Violet.*
Native: In woods, on banks and heathlands. Common. April to July.
Var. *a. Riviniana*, Reich. Frequent throughout the county.
A variety with pure white flowers on Bentley Heath, 1873. A form with large dark blue flowers and small leaves, probably *V. flavicornis*, Forst., is occasional on sandy heath, Sutton Park and Coleshill Heath.
Var. *b. Reichenbachiana. Borean.*
On banks and in woods, in marly and calcareous soils. Local. April to June.
I. Abundant in lanes between Arley and Fillongley; Soas wood, Arbury; lanes about Over Whitacre.
II. Lane about Rowington; Lapworth Street, abundant; abundant in coppice near Drayton Rough Moors; Chesterton Wood; lanes about Exhall and Wixford; Corley Ash.

V. canina, *Auct.* *Dog Violet.*
Native: On heaths and heathy footways. Local. April, May.
Var. *b. flavicornis*, Smith.
I. On heath land, Sutton Park, rather rare. Widely distributed over Coleshill Heath.
II. Milverton, *Y. and B.;* near Shipston-on-Stour, St. Dennis, Honington. F. Townsend; Yarningale Common.

A large form occurs on banks, Coleshill Heath, which may be *V. intermedia*.

V. *lactea, Em.* *Smith's Dog Violet.*
Native: on heath lands. Very rare.
II. Kersley Common, *S. Kirk, Spec. in Herb., Perry.*

V. tricolor, *Linn.* *Heartsease; Field Pansy.*
Native: In cultivated fields, fallows and railway banks. Locally common. April to October.
I. Railway banks, Sutton Park, fields at Boldmir, Coleshill Heath, &c.
II. (*V. Pallouxii,*) Honily and Myton, *Y. and B.;* Lighthorne, *Bolton King;* Drayton bushes, Billesley, &c.

V. arvensis, *Murr.* *Field Pansy.*
Native: In cultivated ground, on banks and fallow fields. Very common, and flowering from April to mid-winter.

(To be continued.)

METEOROLOGY OF THE MIDLANDS.

THE WEATHER OF JUNE, 1881.

BY CLEMENT L. WRAGGE, F.R.G.S., F.M.S., ETC.

The anticyclone of May did not break up until June 3rd, hence bright settled weather and high temperature were the features of the first few days, the heat wave holding until the 4th. A trough came up quickly on the evening of that day, having its centre north-east of Great Britain, and, as secondary disturbances over our islands accompanied it, the conditions of summer depressions (viz., a deep fall of temperature, heavy rain, and cloudy skies) became very marked. Some hail also fell. Exceptionally low temperature followed with the crest in the rear of this disturbance, 27·7° being registered on the ground at Marlborough on the 10th. Vegetation suffered much in consequence, especially in low-lying places. Thence, until the 20th, the oscillations of the barometer and thermometer were comparatively slight. On that day, the second and last great depression of the month approached from the Atlantic, bringing very unsettled weather, with thunderstorms in some places, and more heavy rain. Two small disturbances followed, with showers, but the closing days were finer. In the Staffordshire moorlands the weather was generally cold and showery from the 4th to the end, and it is worthy of notice that the temperature curve for Ben Nevis coincides almost exactly, allowing for the difference in altitude, with that for the moorlands district. Total duration of sunshine reported from Hodsock, 150 hours. Extreme values from radiation instruments, solar, 138·0, terrestrial, 26·1, at Burton and Leicester on the 3rd and 10th respectively. Ozone generally in abundance, the mean daily amount at Buxton being 7·1, and the full amount 10·0, was registered several times in the Churnet Valley. Mean sea temperature at Scarborough, 51·3°. The comet was well observed at many stations.

NOTES BY OBSERVERS. — *Buxton.*—Broom in flower on 3rd, horse-chestnut on 24th. *Spondon.*—Butterflies far more numerous in May than June; a large quantity of white clover bloom. *Nottingham.*—Hay crop late; wheat good and forward; barley very much improved towards end of month; oats not at all good. *Uppingham.*—Webs of geometrical spider, 7th; May-fly, 4th; *Rosa canina,* 7th; *Orchis maculata,* 8th; *Malva sylvestris,* 6th; *Prunella vulgaris,* 17th; *Spiræa ulmaria,* 24th; *Chrysanthemum Leucanthemum,* 10th; *Potentilla anserina,* 3rd.

STATION.	OBSERVER.	RAINFALL. Total for M. In	Greatest fall in 24 hours. In.	Greatest fall in 24 hours. Date.	No. of rainy d.	TEMPERATURE. Greatest ht. Deg	Greatest ht. Date.	Greatest cd. Deg	Greatest cd. Date.
OUTPOST STATIONS.									
Ben Nevis	C. L. Wragge, Esq., F.M.S.	12·3	1··0	30	25	57·2	1	21·5	8
Spital Cemetery, Carlisle	I. Cartmell, Esq.	3·74	·88	30	17	75·8	3	30·4	9
Scarborough	F. Shaw, Esq., F.M.S.	1·26	·15	16 & 20	16	71·1	2	40·5	10
Llandudno	J. Nicol, Esq., M.D., F.M.S.	2·99	1·02	4	19	72·9	2	40·4	8
Altarnun, Cornwall	Rev. J. Power, M.A.	4·18	·75	21	11	77·0	1 & 2	34·0	9
Sidmouth	W. F. Radford, Esq., M.D.	3·67	·56	4	20	76·5	1	37·5	8
Ventnor	J. Codling, Esq.	1·99	·58	5	12	74·7	1	39·1	9
MIDLAND STATIONS.									
GLOUCESTERSHIRE.									
Stroud	S. J Coley, Esq.	3·15	1·42		13	76·0	2, 3, 4	35 0	9
Cheltenham	R. Tyrer, Esq., B.A., F.M.S.	2·32	·73		19	78·0	3	31·5	9
WILTSHIRE.									
Marlborough	Rev. T. A. Preston, M.A.	2·29	·61	5	15	78·2	3	35·1	10
SHROPSHIRE.									
Woolstaston	Rev. E. D. Carr	3·22	·55	6	20	75·0	2	38·0	7 & 8
Stokesay	M. De La Touche	2·93	·42	23	18	79·3	2	35·0	9
More Rectory, Bishop's Castle	Rev. A. S. Male	3·03	[illegible]	17	18	76·0	2 & 3	34·0	8 & 9
Cardington	Rev. Wm. Elliot	3·83	·53	6 & 15	19				
Dowles, near Bewdley	J. M. Downing, Esq.	2·35	·33	25	14	84·0	3	28·0	9
WORCESTERSHIRE.									
West Malvern	A. H. Hartland, Esq.	2·71	·58	5	18	84·0	3	35·5	8
Evesham	T. J. Slatter, Esq., F.G.S.	2·28	·75	5	19	78·3	3	37·0	9
Pedmore	E. B. Marten, Esq.	2·08	·27	5	18	81·0	3	33·0	8
Stourbridge	Mr. I. Jefferies	2·22	·29	5	18	81·0	4	34·0	8
Dudley	Mr. C. Beale	2·19	·39	22	17	72·0	3 & 4	37·0	8
STAFFORDSHIRE.									
Dennis, Stourbridge	C. Webb, Esq.	2·23	·32	15	20	7[illegible]·5	1	34·5	8
Kinver	Rev. W. H. Bolton	2·63	·29	16	19	79·0	4	35·0	8
Walsall	N. E. Best, Esq.	2·42	·38	5	17	72·0	1	39·0	8
Lichfield	J. P. Roberts, Esq.	2·35	·30	5	19	88·0	1	37·0	8
Grammar School, Burton	C. U. Tripp, Esq., M.A.	2·27	·45	17	16	81·0	1	34·0	8
Wrottesley	E. Simpson, Esq.	2·42	·32	24	16	76·2	3	34·8	9
Heath House, near Cheadle	J. C. Philips, Esq., J.P.	2·40	·29	22	20	75·3	1	36·8	9
Oakamoor	Mr. E. E. Kettle	2·30	·34	16	17	76·1	2	32·3	9
Beacon Stoop	Mr. James Hall	1·67	·33	22	15	70·9	2	32·3	9
Alstonfield	Rev. W. H. Purchas	3·10	·47	17	16	83·0	2	30·3	9
WARWICKSHIRE.									
Henley-in-Arden	T. H. G. Newton, Esq.	2·66	·76	5	18	83·5	1	35·0	9 & 10
Park Hill, Kenilworth	T. G. Hawley, Esq.	1·97	·50	5	13	78·1	1	36·9	10
Coundon, Coventry	Lieut.-Col. R. Caldicott	2·17	·24	10	17	80·0	3	40·0	7, 8, 9
Rugby School	Rev. T. N. Hutchinson	3·75	1·10	7	16	78·0	1 & 3	36·6	9
DERBYSHIRE.									
Buxton	E. J. Sykes, Esq., F.R.A.S.	3·14	·59	21	15	75·4	2	34·4	9
Stony Middleton	Rev. U. Smith	2·32	·39	21	16	77·0	1 & 2	35·0	8
Fernslope, Belper	F. J. Jackson, Esq.	2·31	·32	16	16	76·0	1 & 4	37·0	9
Spondon	J. T. Barber, Esq.	2·04	·30	5	16	66·0		31·0	
Linacre Reservoir	C. E. Jones, Esq.	1·34	·19	16 & 17	17				
Duffield	W. Bland, Esq.	2·35	·37	19	15				
NOTTINGHAMSHIRE.									
Park Hill, Nottingham	H. F. Johnston, Esq	1·83	·31	6	13	76·8	1	39·1	8
Hodsock Priory, Worksop	H. Mellish, Esq., F.M.S.	1·59	·23	21	18	78·0	1	35·3	8
Tuxford	J. N. Dufty, Esq., F.G.S.	1·82	·51	18	18	71·0	2	34·0	8
LEICESTERSHIRE.									
Loughborough	W. Berridge, Esq., F.M.S.	1·88	·44	6	18	83·2	1	35·8	8
Syston	J. Hames, Esq.	2·07	·65	6	18	84·0	2	35·0	9
Town Museum, Leicester	M. Browne, Esq., F.Z.S.	2·59	·67	6	16	79·0	1	36·2	7
Ashby Magna	Rev. Canon Willes	1·84	·50	5	17	82·0	1		
Waltham-le-Wold	E. Ball, Esq.	2·53	·7	6	14	78·0	2	34·0	8
Dalby Hall	G. Jones, Esq.	2 14	·67	6	15	90·0	3	29·0	9
Coston Rectory, Melton	Rev. A. M. Rendell	1·81	·52	6	16	76·2	1	35·8	8
NORTHAMPTONSHIRE.									
Towcester	J. Webb, Esq.	2·04	·87	5	15	81·0	3	34·0	9
Kettering	J. Wallis, Esq.	2·23	·85	5	14	76·0	2	38·0	9
Althorp	C. S. Groom, Esq.	2·15	·91	5	13	77·0	1 & 2	34·0	9
OXFORDSHIRE.									
Ratcliffe Observatory, Oxford	E. J. Stone, Esq., F.R.S.	1·89	·77	6	15	78·5	2	38·5	9
RUTLAND.									
Northfields, Stamford	W. H. Hayes, Esq.	2·09	·61	5	14	78·0	23	32·0	9
Uppingham	Rev. G. H. Mullins, M.A.	1·80	·65	5	14	84·6	3	35·3	9

Beacon Stoop—May: Rainfall, 1·31, Greatest Fall, ·39 on 27th; Rainy Days, 13; Max., 71·2 on 31st; Min., 31·5 on 4th.

N.B.—Several returns for June arrived too late.

Correspondence.

Botanical Note, July 9th, 1881.—Having walked this afternoon to a Common about five miles from this town, I met with one or two plants, the record of which may be interesting to botanists. In some very wet ground I was surprised to find a specimen of the Royal Fern, *Osmunda regalis*, being rare in this district; a small portion of which only I gathered, leaving the large root as it was. Near this was a great quantity of the Marsh Cinque-foil, *Potentilla Comarum*, well in flower, growing among dense moss, and so wet it was not easy to reach a plant. After some search I found also a few heads of the Cotton-sedge, *Eriophorum polystachyon*, sparingly growing in boggy peat, and which also has few localities near here. Unusually large plants of the Tway-blade, *Listera ovata*, were still in flower in damp spots, one measuring fully twenty-five inches high, with flowering portion eight inches long, and leaves about four inches wide. At the margin of a pool on the Common were a few Water Dropworts, *Œnanthe fistulosa*, only seen at one spot. Upon returning over a less frequented part of a neighbouring heath, the waxy-looking and some nearly white flowers of the cross-leaved heath, *Erica tetralix*, formed large masses of bloom; while it formed a pleasant sight to come upon a showy cluster of the comparatively common Viper's Bugloss, *Echium vulgare*, with some spikes of flowers about two feet long. Though not yet in flower, it was interesting to find *Dipsacus pilosus*, the small Teasel, associated with *Eupatorium cannabinum* and the beautiful yellow Flag, growing above some large flowers of late Forget-me-not, in damp spots beside a stream; also to gather the Meadow Cranesbill, *Geranium pratense*, one of our loveliest wild flowers, which is rare or almost unknown within several miles of this town, and which I have not previously found so near as this distance of about two miles and a half: for this was upon my return journey. I may remark that, while resting at a pool on the Common, a Heron rose from some Scotch Pines on the far side, and curved once or twice above the surface, near enough to shew the soft grey tone of his wide wings, then sailed away majestically towards the south.—Horace Pearce, F.L.S., Stourbridge.

Plants in Dorsetshire.—After the meeting of the Midland Union of Natural History Societies at Cheltenham, I went on into Dorsetshire, where I found the following plants of more or less rarity, the first five I had not gathered before:—*Lathyrus Aphaca, Carum Carvi, Melittis Melissophyllum, Pinguicula lusitanica, Herminium Monorchis, Drosera intermedia, Silaus pratensis, Carduus Marianus* and *pratensis, Orobanche Hederæ, Samolus Valerandi, Daphne Laureola, Ophrys apifera*, and *Ruscus aculeatus;* also near Christchurch, Hants, *Butomus umbellatus.*—O. M. Feilden, Frankton, Salop.

A Canary escaped from its cage in this place and was out for nine or ten days living about in the trees, &c., around the house in which it had lived. During this time it was observed to find difficulty in getting sufficient food itself, at any rate several common sparrows were frequently seen actually feeding the canary by putting food into its mouth, as if feeding young birds.—W. S. Gresley, Overseal, Leicestershire, July 29th, 1881.

Ornithological Notes.—Most of our song birds are silent now though at times we hear the Thrush, Blackbird, Hedge Sparrow, Wren, Linnet, Chiffchaff, Blackcap Warbler. The Cuckoo has as usual been silent all the month. We have still some nests with eggs in of the Reed Warbler, Redpole, Green and Common Linnets, plenty of House Sparrows, with eggs and young ones, and some young Thrushes.—H. G. Tomlinson, Woodlands, Burton-on-Trent, July 23, 1881.

Dragon Fly's Eye.—In dissecting a small Dragon Fly *(Agrion)* a few days ago I noticed some peculiar markings on the eyes; they were of deudritic form, and covered a considerable part of the cornea. Each eye was marked to about the same degree, but they differed much in their arrangement; for while one had a finely branching piece and five small ones, the other had about ten small, though similarly-shaped, markings only. I have dissected many insects, including several kinds of Dragon Flies, but do not recollect seeing such deudritic spots on the eyes before. The thought occurred to me, could they be veins? but if so the two eyes would probably match. However, I have looked over several slides of Dragon Flies, about ten in number, and find the eyes of two of them show similar markings, though not to the same extent; so thinking a note on it might be interesting to readers of the "Midland Naturalist," I record it, hoping if such marks are not of unfrequent occurrence some light may be thrown on their purpose; or if rare, (which I do not think they are,) that Entomologists may notice the conditions under which they are to be found.—J. W. Neville, Wellington Road, Handsworth, June 30th, 1881.

Neolithic Celt from Leicestershire.—In June, 1880, I examined a finely-finished stone implement, then in the possession of Mr. Nixon, of Claybrooke, near Stoney Stanton. It had been found in "Coley's Field," about 2½ feet below the surface. It was 5½ inches long, 2¾ inches broad, and 1⅓ inches thick, broad at the cutting edge, and tapering thence to the other (blunt) end. It had a ground semi-circular cutting edge. The material appeared to be the local Syenite.—W. J. H.

Palæozoic Rocks Beneath Northamptonshire.—Many members of the Midland Union, who attended the annual meeting at Northampton, in 1880, will remember their visit to the site of the boring then in progress near Northampton, the object being to obtain a supply of water for the town. The boring was then in the Lias, but it has since passed through that formation and struck the *Carboniferous* Limestone at a depth of 890 feet. From the cores brought up, Mr. Etheridge has determined the fossil corals *Lithostrotion junceum* and *Lonsdaleia floriformis* in abundance. This discovery seems to show a southerly extension of the Pennine axis, and renders probable the existence of a coalfield between Northampton and Nuneaton.—W. J. H.

Reports of Societies.

BIRMINGHAM NATURAL HISTORY AND MICROSCOPICAL SOCIETY.—A meeting of the Geological Section was held at Mason College, on the 28th June, the President (Mr. W. J. Harrison, F.G.S.) in the chair. Mr. J. Bagnall exhibited a fragment of a fungus, *Polyporus squamosus*, from a specimen two feet in diameter, growing on an elm tree at Drayton Bushes, near Stratford-upon-Avon. Mr. H. W. Jones showed a fine specimen of the Toper fish or Miller's Dog, *Galeus canis*, caught in Colwyn Bay. Mr. W. J. Harrison exhibited a microscopic section of gneiss, or micaceous schist, as it is termed by some geologists, from Brazil Wood, Charnwood Forest. Dr. C.

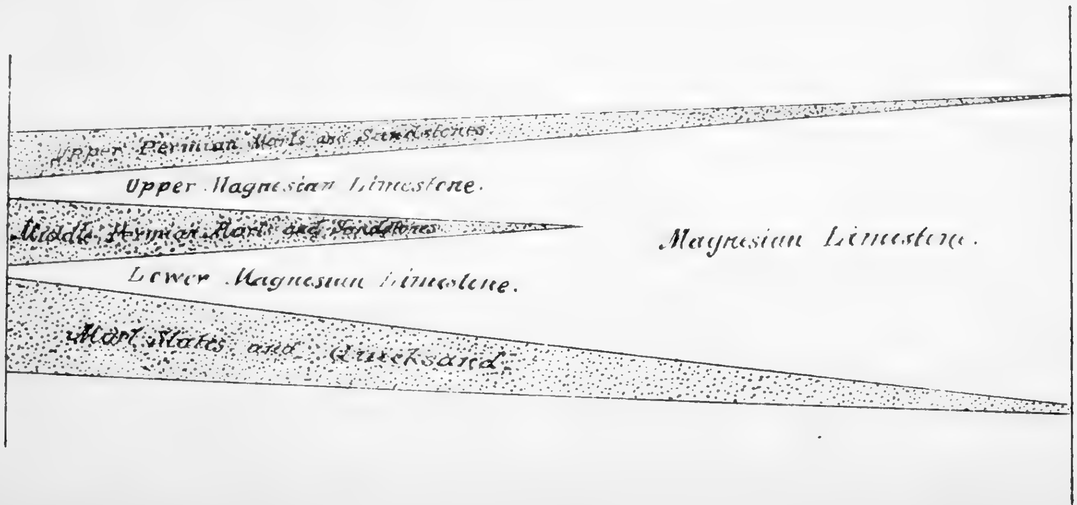
Callaway, F.G.S., gave a paper on "How to Work in the Archæan Rocks." This is a term applied to those stratified metamorphic rocks which underlie the Lower Cambrian in the British Islands. They consist of gneiss, mica schist, quartzite, halleflintas, &c., and during the last few years have been well worked by a few well-known geologists. They are found in the North of Scotland, Anglesey, Carnarvonshire, and Shropshire, and at St. David's, the Malvern Hills, and Charnwood Forest. The lecturer described their structure and mode of occurrence at these localities, and also the tests by which the order of superposition of the various beds is ascertained, for on account of the absence of fossils, and the faults which abound in these rocks, this is a difficult matter. He also mentioned that recent research appears to lead to the conclusion that all rocks which have undergone regional metamorphism belong to the Archæan system. The paper was followed by a brief discussion. At a meeting on the 19th July, Mr. Bolton exhibited under the microscope two species of Hydrozoa, Obelia, and Clytia, with their free-swimming medusifrom gonophores. Mr. W. J. Harrison exhibited large and small varieties of *Lima gigantea*, from the Lias of Barrow-on-Soar; pitchstone, from a dyke in Ayrshire; and a Serpula on an Ammonite. Mr. J. F. Goode exhibited the tail of a lizard, which had been found in the Belgrave Road, alive and wriggling about, but the body was not discovered. Mr. W. P. Marshall exhibited a piece of slate, from the Californian brick pits near Harborne, on which were distinct glacial scratches and striæ; also some micaceous laminated sand from the same place, both of which had been obtained during the Saturday afternoon excursion. He also exhibited the specimens of Virgularia and Pennatula, which had been dredged at Oban; and made some remarks upon the other marine animals which had been brought from that place. He stated that the water in which they were found, being in a land-locked basin, was sensibly not as salt as the sea, but it was not certainly ascertained whether the bottom water, in which the creatures had actually lived, might not be salter than that at the surface. July 26th.—GEOLOGICAL SECTION.—Mr. J. F. Goode exhibited a slide of Foraminifera, found at Dog Bay, Ireland, by Mr. J. Morley. Mr. A. H. Atkins, B.Sc., and Mr. W. H. Cox, exhibited specimens of fossils and striated pebbles from the boulder clay, at California, near Harborne. Mr. W. J. Harrison, showed some quartzite pebbles, from the drift beds of Moseley and Sparkbrook, containing *Orthis Budleighensis* and *Modiolopsis armorici*. Mr. Harrison then opened a discussion on the origin of these pebbles, which was joined in by the members present. Fossils are not very abundant in these quartzites, about one pebble in ten thousand containing them; but when found they are identical with species occurring at Budleigh Salterton, in Devonshire, and *in situ*, in the Lower Silurian rocks of Normandy. This is a curious fact, as the drifts of the Midland Counties have been supposed to come from the north and west, and also to have been derived from the waste of the conglomerates of the Triassic formation. There are, no doubt, many specimens in the gravel pits round Birmingham which would tend to solve these difficulties, and a careful examination would well repay any one interested in geological research.

NOTTINGHAM WORKING MEN'S NATURALISTS' SOCIETY.—The Society, through an invite from the Mayor and Sheriff, attended a conversazione on June 30th and July 1st, in honour of the opening of the new University College by H.R.H. Prince Leopold, Duke of Albany, K.G.—July 4th. The monthly exhibition of the society was held, when Mr. J. Hazard exhibited some very rare Moths taken by him in this locality this season and last, including *Thyatira deras*, *Acronycta rumicis*, *Leucania lithargyria*, *Gotyna flavago*, *Hydræcia micacea*, *Neurica saponariæ*, *Heliophobus popularis*, *Apemea oculea*, *Miana strigilis*, *Miana fasciuncula*, *Triptæna subsequa*, *Noctua glaressa*, *Tæniocampa rubricosa*, *Xanthia citrago*. *Euperia fulvago*, *Eremobia octoroleuca*, *Poplia chi*, *Brephos parthenias*, *Eucullia scrophulariæ*, *Phytometra ænia*, and several others. A nest of a social Wasp, *Vespa Britannica*, was found at Newstead on June 26th by Mr. Perrey, suspended on a branch of hawthorn. Mr. Goldsmith presented to the Society several parts human bone, and also showed several sections under the microscope. Several bouquets of wild flowers and other specimens were shown by the members.

Diagram illustrating the tendency of the Calcareous and Sedimentary Members of the Permian Formation in the North-East of England to mutually replace each other.

MID-LINCOLNSHIRE

S. E. DURHAM



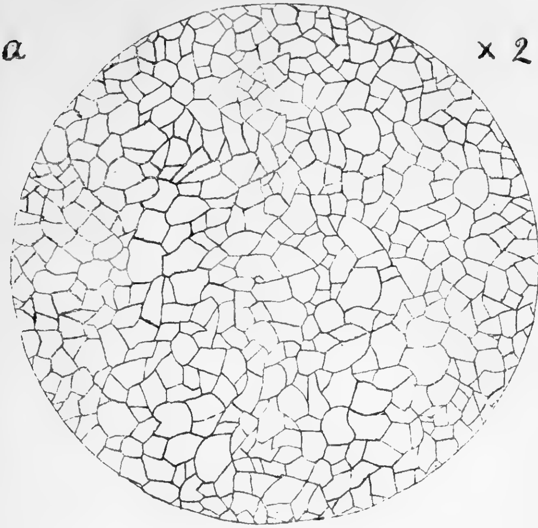
Sedimentary

Calcareous.

Vertical Scale 400 feet to 1 inch. Horizontal Scale much exaggerated.

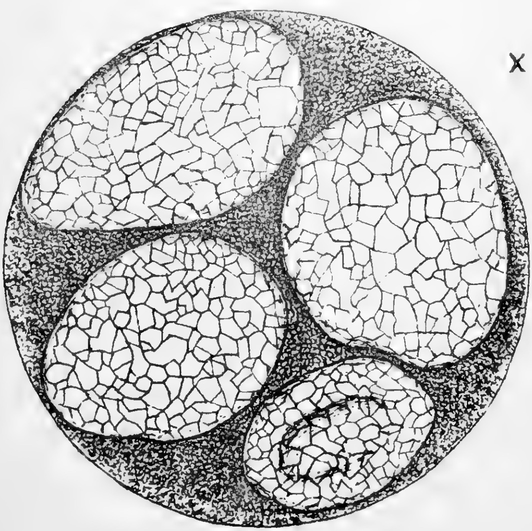
Lower Magnesian Limestone. CRESWELL, DERBYSHIRE.

a × 25.



Permian Marl Slates (oolitic) KIMBERLEY, NOTTS

b × 25.



THE PERMIAN FORMATION IN THE NORTH-EAST OF ENGLAND,

WITH SPECIAL REFERENCE TO THE PHYSICAL CONDITIONS UNDER WHICH THESE ROCKS WERE FORMED.

BY E. WILSON. F.G.S.

(Continued from page 191.)

Development of Calcareous and Sedimentary Members in opposite (viz., North and South) Directions. *(a)*

The Magnesian Limestone attains its maximum development in the extreme north. In South Durham vertical sections have proved these rocks to exceed 600ft. in thickness. *(b)* Where most fully developed in Yorkshire, they are not more than 450ft. In extreme South Yorkshire and North Notts they do not materially exceed 150ft. or 200ft.; and in the extreme Southen portion of their range, through the latter county, we find these dolomitic rocks, along with the other members of the Permian formation of the North-east of England, gradually fade away one after another—going South. The Upper Magnesian Limestone disappears near Worksop. The Lower Magnesian Limestone rapidly attenuates south of Mansfield, and eventually dies out near Nottingham. South of Nottingham the Permian Rocks are absent at the surface, and explorations for coal at various points in and South of the Trent Valley, *e.g.*, Wilford Colliery sinking, and the Clifton, Highfields, Chilwell, and Owthorpe borings, have conclusively shown that they do not set in again further South, for at all these points the New Red Sandstone has been found resting directly on Coal Measures. In tracing the Magnesian Limestone southwards, we observe not only that the group of rocks bearing that name gradually dies away as a whole, but we also notice that the formation, which is almost wholly calcareous on the North, becomes intercalated with sedimentary deposits, and that the latter become relatively more and more important the further south we go. In South Durham the 600 odd feet of Permian rocks consist entirely of dolomitic limestone; in South Yorkshire there cannot be more than 200ft. or 300ft. of Limestone; in North Notts the maximum thickness of Limestone falls short of 100ft.; south of Mansfield the Lower Magnesian Limestone is less than 50ft. in thickness; at South Scarle the two Limestones

(a) Professor Hull and others have supposed that in the North of England a mutual replacement of calcareous and sedimentary deposits of Permian age took place in an East and West direction, and that a sedimentary series in Lancashire and Cumberland balance a calcareous series in Notts, Yorkshire, and Durham. (See Q.J.G.S., vol. xxv., p. 176; Geol. Mag., 1879, p. 574; Jukes' School Manual of Geology, Permian Formation.) This cannot be so, however for there is abundant evidence to show that these East and West Permian areas were physically disconnected. (See "Age of the Pennine Chain," Mid. Nat., vol. iii., pt. 1, 1880.)

(b) Note.—632ft. of Magnesian Limestone dolomites were passed through in Castle Eden Colliery.

together are only 66ft. thick. Finally, at Nottingham, the Magnesian Limestone dies out altogether. Whilst the calcareous members of the formation attenuate on the south, the intervening sedimentary deposits simultaneously expand. In Durham it is very problematical whether the Upper Permian Marls are present, and if they are, they must be intercalated with some thick bands of Limestone (see Middlesboro' sections.) In South Yorkshire these Upper Marls are in places at least 50ft. in thickness; and at South Scarle, Lincolnshire, between 80ft. and 100ft. A middle series of Marls and Sandstones unknown in Durham, or the North Riding of Yorkshire, become let in further south between the Upper and Lower Limestones. In South Yorkshire these Middle Marls have a thickness of from 30ft. to 50ft.; and at South Scarle of 140ft. The Marl Slates, which consist of a variable series of Shales, Sandstones, and Limestones, of which the sedimentary constituents on the whole predominate, in Durham vary from a yard or so up to 30ft. in thickness; and in Yorkshire, when visible along the Magnesian Limestone escarpment, are not more than 10ft. or 12ft. in thickness, but under parts of Notts (between Shireoaks and Mansfield) attain a thickness of from 50ft. to 150ft., and at South Scarle of well nigh 200ft.

The accompanying diagram will roughly represent the mutual interlacings of the calcareous and sedimentary members of the Permian formation in the north-east of England. (See Fig. 3, Plate VIII.)

Origin of the Permian Rocks of the North-east of England.

Professor Ramsay some years ago enunciated the theory that the Magnesian Limestone of England was formed in part, at least, by direct *chemical* precipitation in inland salt lakes, comparable, in some respects to the Great Salt Lake of Utah, and in its restricted fauna to the far greater salt lake of the Caspian Sea, and which lakes, like the latter, may possibly have been previously connected directly with the open sea. *(a)* . "The Gypsum, the Dolomite or Magnesian Limestone, the Red Marls covered with rain pittings, the suncracks and the impressions of the foot-prints of reptiles made on the soft, sandy marls when the water was temporarily lowered by solar evaporation in successive summers, all point to the fact that the Permian strata were not deposited in the sea, but in a salt lake or salt lakes once for a time connected with the sea. *(b)* Dr. T. Sterry Hunt had already independently arrived at the same conclusion for all Magnesian Limestones. According to that eminent physicist, Dolomites, Magnesites, and Magnesian Marls have been formed by the evaporation of solutions of bicarbonate of magnesia, which have been produced either by the action of bicarbonate of lime upon solutions of sulphate of magnesia (in which case gypsum is a subsidiary product) or by the

(*a*) "On the Red Rocks of England of older date than the Trias," by A. C. Ramsay, F.R.S., Q.J.G.S., vol. xxvii., p. 24.

(*b*) Presidential Address to British Association, 1880, by A. C. Ramsay, LL.D., F.R.S.

decomposition of solutions of the sulphates or chlorides of lime and magnesia by waters of rivers or springs containing bicarbonate of soda. *(a)* *(b)*

Dr. Sorby, on the other hand, holds to the belief that the Magnesian Limestone was at first in great part *organic*, but that the rock has since become so thoroughly crystalline as to have almost entirely lost its original structure—that some chemical replacement has taken place, though there may have been a *certain amount* of chemical precipitation at first—and that a combined organic and chemical origin appears more probable than either alone, though it may be difficult to decide to what extent each was instrumental in producing the main mass of the deposit on account of the original structure having been so completely lost. *(c)*

My own studies among the Magnesian Limestone deposits of the north-east of England, so far as they have gone, have certainly led me to accept the theory of the direct chemical origin of the bulk of these rocks as the correct one. The crystallisation of the magnesian salts was, I believe, synchronous or nearly so with the formation of these dolomites and the entombment of their organic remains. The general paucity and the stunted aspect *(d)* of the marine fauna seem to demand some such special explanation, as the co-existence of concentrated mineral waters suggested by Ramsay. When fossils are present in these rocks, they or their casts are clearly enough defined at certain horizons, even when the rock is most coarsely crystalline, while the intervening beds are to all appearances perfectly destitute of organic remains. The most minute forms of life—foraminifera and entomostraca—are found at times, though in small numbers, yet perfectly well preserved. How can the bulk of the rock have been recrystallised, and the larger fossils or shelly *debris* wholly obliterated without at the same time all trace of these *minute* organisms being destroyed? Truly certain beds of Magnesian Limestone (*e.g.*, shelly and polyzoan limestones in Durham and Yorkshire) are almost entirely composed of the

(a) Chemical and Geological Essays, by T. Sterry Hunt, LL.D., reprinted 1875, p. 90.

(b) It is to be noticed that while both these reactions give us the elements of dolomite, neither of them produces directly dolomite itself. The union of the carbonates into true dolomites or dolomitic Limestones, Dr. Hunt thinks, must have been brought about afterwards by the aid of pressure and elevated temperature. Bearing in mind, however, the tendency towards the formation of double salts which magnesia is stated to exhibit, it seems not impossible that combination may take place slowly by simple chemical affinity. We cannot say then that the problem of forming dolomite by direct precipitation has yet been solved experimentally. Imperfect, however, as has been at present the success of experimenters, they have got quite far enough to justify the belief that the process consisted of some reaction between calcareous and magnesian salts in solution. What those salts were and what was the exact nature of the reaction have yet to be learned.—"Geology for Students," by A. H. Green, M.A., F.G.S., 2nd ed., p. 206.

(c) Anniversary Address to Geological Society, H. C. Sorby, LL.D., F.R.S., 1879, Q.J.G.S., vol. xxxv., part 2, p. 39.

(d) All the forms of mollusca found in the Magnesian Limestone of the north-east of England, with scarcely a single exception, are small and dwarfed in aspect compared with their carboniferous congeners, when such there are.—Ramsay, A.C. (Loc. cit.)

whole or fragmentary remains of these organisms; but this in no way disproves the direct chemical origin—and still less proves the organic origin—of the major portion of these rocks. The finer grained Magnesian Limestone dolomites, such as those of Mansfield Woodhouse, Cresswell, and Kirkby, (and I believe the same remarks will apply to the more coarsely crystalline also,) when a microscopic section has been made, are seen to consist of uniformly-sized and shaped rhombic crystals of dolomite, more or less stained with iron oxide, and intermixed with a few scattered quartz grains. (See Fig. 4*a*.) Had dolomitisation of these rocks taken place after their formation, this could only have been caused by extensive and intimate infiltration of waters holding mineral matter in solution, in which case we should surely have seen some indications of this process. But we do not. We see no traces of infiltration, no (microscopic or larger) veins of calcite or other mineral, but regular crystals of dolomite, which by polarised light, appear to be simple crystals of homogeneous structure. Then again, the Upper Limestone, (or Brotherton Beds of Yorkshire,) which is only separated by a few feet of marl from the Lower Magnesian Limestone, and sometimes rests directly upon that rock, is, as a general rule at any rate, non-dolomitic. The underlying Marl Slates, too, are by no means generally dolomitic throughout. By what agency could the Lower Magnesian Limestone be afterwards dolomitised, and the Marl Slates and Upper Limestone escape the process?

In the face of the foregoing facts, it appears to me impossible to suppose that the Magnesian Limestones of the north-east of England were *mainly* organic in origin, and have long subsequently undergone the wholesale dolomitisation and crystallisation which that theory presupposes. I believe, on the other hand, that these crystalline dolomites were originally formed as such, and that the proportionate value of organic life in building them up is approximately given by the small amount that is now visible to the naked eye or revealed by the microscope. Long after their deposition, the coarsely crystalline dolomitic beds appear to have been subjected to the infiltration of carbonated waters, whereby the excess of carbonate of lime and the calcareous fossils were removed, leaving the mass of the rock as we now so commonly find it, porous in texture, and with only the hollow casts (*a*) (or moulds) of the fossils left.

Let us now proceed to consider the probable physical sequence of events that took place in the north-east of England in Permian times. (*b*)

The Permian area of the north-east of England appears to have originally consisted of a single pretty level flat-bottomed basin, or of

(*a*) A common and suggestive phenomenon met with in Dolomitic Limestones of all ages.

(*b*) I must premise, however, that from the necessarily imperfect state of our information on the subject, the following remarks are largely of a speculative nature.

a series of shallow (*a*) lagoons bordering the sea. This region was shut in on the west by an elevated tract of ground, the Pennine chain, (*b*) and by a broader mass of low-lying ground, interspersed, however, with hilly districts on the south. What the eastern or northern boundaries of this area were it is impossible now to say, but it is clear that there must have been some sort of communication with the open sea in a north-easterly direction.

The sequence of events in this area appears to have been as follows :—

Subsidence in the first place lets in the waters and inhabitants of the sea. The incoming waters breaking in during a comparatively brief period of extreme shallowness and consequent violence (*c*) wore into the carboniferous rocks forming the floor and margin of the Permian basin, and out of the waste of these rocks the basement breccia of the Marl Slates of Notts and Lincolnshire was mainly built up. Rivers, that took their rise on the bordering high lands on the west and south, discharged their waters (and sediments) into these lagoons. The streams that rose on the high ground of the Pennine chain, inflowing from the west, would probably be of smaller size, and carry down less but coarser sediment than those inflowing from the south, the watershed being less distant, and the fall consequently steeper in the case of the former. The "Quicksands" of Yorkshire, which appear to lie in channels cut out of the underlying carboniferous rocks, and in their general structure also agree with the "rock faults" met with in the coal measures, may very possibly represent, as Prof. Green (*d*) has suggested, the deltoid deposits of such streams. Subsidence continuing, the shales, sandstones, and dolomites that constitute the Marl Slate series, were next laid down in the shallow but tranquil and sheltered waters of the period. The sedimentary (and chemical) constituents of these beds, were, I think, mainly washed down into the Permian basin along with the remains of land plants, reptilia, and fresh-water amphibia and fishes (*e*) by rivers swollen during periodical floods. The streams inflowing from the west, fed by

(*a*) The presence of ripple marks, suncracks, annelid burrows; the remains of land plants, and occasionally of amphibia and reptilia in these rocks; as also according to King, "the absence of corals and the character of the shells" prove that they were formed in shallow water.

(*b*) The Pre-Permian age of the Pennine Chain may now be considered as established (Loc. cit.)

(*c*) N.B.—It is to be understood that nothing more violent than a rapid incursion of the sea over the subsiding floor of a large level-bottomed lagoon is here suggested.

(*d*) "On the Method of Formation of the Permian Beds of South Yorkshire," by A. H. Green, M.A., F.G.S. Geol. Mag., vol. ix., p. 99.

(*e*) The ganoid fishes of the Marl Slates have generically strong affinities with those of the coal measures. Prof. Miall says it is not easy to decide whether the latter were marine or fresh-water, but infers, from their absence in the Mountain Limestone, where Elasmobranchs abound, and their abundance in the coal measures, where Elasmobranchs are almost unknown, that they were mostly fresh-water, though some may have been marine, or made seasonal migrations from salt-water to fresh. "Coal: Its History and Uses. The Animals of the Coal Measures," pp. 135-6.

carbonated, alkaline, and ferruginous springs, which doubtless, then as now, broke forth in considerable numbers on the Millstone Grit and Yoredale borders of the Yorkshire area, the coal measure country of Yorkshire and Derbyshire, and the Carboniferous Limestone hills beyond, would carry down in solution and in quantities practically without limit, all the mineral ingredients necessary for the production of dolomitic Limestone, Gypsum, and (?) Rock Salt, as also of the iron compounds that are found in the Permian rocks of the district. (*a*) Some time would elapse before a state of saturation high enough to cause precipitation was reached. At first then, only mechanical deposits would be formed. These are the "Quicksands." After a time the waters would become sufficiently saturated to cause dolomitic materials to be thrown down to some extent, which commingled with the sand and mud, as also with the large supplies of ferrous carbonate (undecomposed in the presence of so much decaying vegetable matter) likewise brought down by the rivers, would give rise to the blue coloured plant bearing dolomitic sandstones and shales of the Marl Slate series. During this stage mechanical deposition predominated, on the whole, over chemical precipitation; but microscopic and chemical examination alike show that some of the beds are true Dolomites, (See Plate IX.,) while others appear (from their brisk effervescence with an acid) to be non-dolomitic Limestones. Subsidence went on chiefly in the South, or rather South-eastern parts of the known portion of the above Permian area, for it is in that direction that we find these Marl Slates gradually thicken out. Plant life appears to have flourished abundantly, and in some variety on the adjacent land; the aquatic fauna, however, appears to have been extremely limited, only a very few bivalve molluscs, and the tracks of annelids, in addition to the ganoid fishes, having been found in these beds. Somewhat suddenly—but without the slightest discernible physical disturbance—this state of things came to an end. Chemical precipitation now began to predominate over mechanical deposition, and the formation of the white and yellow Dolomites of the Magnesian Limestone stage commenced. Some special explanation is, I think, needed to account for this sudden change. I would explain it by supposing the climate to have become warmer. (*b*) As a result of the increased summer's heat, there would be greater evaporation, and, consequently, greater precipitation of mineral matters. The rainfall also might be thus lessened, so that the rivers would carry down less

(*a*) Prof. Green (Loc. cit.) looks to mineral springs produced by volcanic activity to furnish the mineral salts of lime and magnesia, as also of iron which we find so abundantly in the Magnesian Limestone of the north-east of England. But there is no evidence of volcanic activity in this district in Permian times, and there is really no necessity to fall back on such an hypothesis. The Millstone Grit alone might furnish iron enough; the whole system is replete with iron, in the form of bisulphide and carbonate. All over its surface now, thousands of springs break out copiously charged with iron. The Carboniferous Limestone is itself sometimes magnesia: ordinary mineral springs will supply the necessary salts of lime and magnesia.

(*b*) "It is in dry and desert regions with closed lake or sea basins," says Dr. T. Sterry Hunt, "that we must seek for the production of Magnesian Carbonates."—*Op. cit.*

fresh water and less sediment into the Permian lagoons than previously, and, ceasing to overflow their banks, would no longer carry away the quantities of land plants, brought down during the Marl Slate stage. (*a*) Subsidence continued during this stage, accelerating in amount northwards, through Yorkshire to Durham. This movement, by diminishing the altitude of the catchment area, while increasing the area of evaporation would, to a certain extent, tend to promote the condensation and precipitation of mineral matters in the land-locked waters of the period. The southerly intercalation of sedimentary beds between calcareous deposits, viz., the Middle Marls and Sandstones, may have been due to the influx of rivers from the land lying on the south, which, like that on the west, appears to have remained unsubmerged during the whole of the Permian period. The presence of gypsum, however, in these beds shows that chemical action still continued actively at work. This chemical deposit, as well as the ripple marks and suncracks met with in these beds, demonstrate the extreme shallowness of the waters in which they were formed. The Upper Permian Marls may perhaps be similarly accounted for, and possibly indicate the approaching termination of salt lake conditions.

Here, then, the record of the physical succession of events in the North-east of England during Permian times abruptly terminates.

While the Magnesian Limestone was forming, the fauna appears to have been limited in variety, and, as a rule, in number of individuals, except for a time in the Durham district, where the waters appear to have been, on the whole, somewhat deeper, and therefore sweeter than further south in South Yorkshire and Notts. This fauna is, indeed, distinctly marine, but the species are comparatively few in numbers, and, as a rule, dwarfed in size, such as we might expect to find in an inland lake or lagoon, once for a time connected with, but that had since become cut off from communication with the open sea. On this hypothesis, however, the distribution of this dwarfed marine fauna—almost wanting in the lowest beds, (Marl Slates,) more numerous in the Lower Limestone, (especially of Yorkshire and Durham,) and in Durham still more numerous in the middle portion of the Magnesian Limestone—compel us to suppose that between the open sea and the westerly limits of the Permian basin of the North-east of England, there must have been one or more intervening lagoons, across which very few forms of animal life succeeded in making their way in Marl Slate times. Into those regions, however, in Lower Limestone times a certain number of *already dwarfed* animals had succeeded in penetrating. In Middle Limestone (= upper part of Lower Limestone ?) times, a larger migration took place into the Durham area. Nearly half of these had lived in Yorkshire during Lower Limestone times, but very few succeeded in making their way into Notts, where,

(*a*) Hence also the change in the colouration of the rocks; the iron, in the absence of these decaying organic matters, being now thrown down as the yellow hydrated ferric oxide, or a red coloured compound of iron, instead of as the colourless or grey ferrous carbonate.

as we have seen, the conditions were probably less favourable to existence. Very few, indeed, of the forms of life met with in the Lower Limestone survived into the Middle Limestone (or small-grained Dolomite) of Yorkshire. Indeed, after the deposition of the Lower Limestone, (proper,) and during that of the small-grained Dolomite, it would appear as if there had been a total withdrawal of species from the South Yorkshire area. During the same epoch, however, (if the correlation of these rocks by Mr. Kirkby *(a)* may be considered as established,) the fauna reached its maximum development in the Shelly Limestone of Durham. Prior to the commencement of the Upper Limestone stage, the exodus of the marine fauna throughout the whole Permian area of the North-east of England was most pronounced, only two species of mollusca coming back in the Upper Limestone of Yorkshire, both now excessively dwarfed, shewing the severity of the struggle they had gone through *(b)*, and only three or four species being found in the Upper Limestone of Notts and Durham.

It thus appears that the waters of the saline lagoons in which the Permian rocks of the North-east of England were formed, which had for a time become connected with the open sea, after this connection had been put an end to, became more and more saturated with mineral salts as time rolled on, and less and less fitted for the habitation of living beings.

These living forms in the first place entered the area slowly, their retreat having been a little later on cut off by closure of the outlet; they were driven hither and thither, according as the physical conditions of existence became locally more or less incapable of supporting animal life. In the end, (unless successful in withdrawing themselves through a temporarily reopened outlet,) they must have been entirely exterminated by the finally unendurable salinity of the waters.

THE FLORA OF WARWICKSHIRE.
AN ACCOUNT OF THE FLOWERING PLANTS AND FERNS OF THE COUNTY OF WARWICK.

BY JAMES E. BAGNALL.

(Continued from page 196.)

DROSERACEÆ.
DROSERA.

D. rotundifolia, *Linn.* *Sundew.*

Native: In marshes and bogs. Very rare. July, August.

I. Birmingham Heath, *With.*, ii., 405; Coleshill Heath! *Bree, Mag. Nat. His.*, iii., 165; Sutton Park! *Freeman, Phyt.*, i., 262. Formerly abundant in Sutton Park, but now very rare; Coleshill Pool and bog; bog near Little Packington.

(a) Loc. cit.

(b) According to Kirkby, *Axinus dubius*, while fully two inches wide in the Lower Limestone of Yorkshire, is not half an inch in width in the Brotherton Beds. Loc. cit.

This plant is rapidly disappearing from the various stations in the county, partly from drainage operations, but more especially from the greediness of collectors and would-be cultivators.

POLYGALACEÆ.

POLYGALA.

P. vulgaris, *Linn.* *Milkwort.*

Native : On banks, heaths, and heathy way-sides. Common. May to September.

I. Vars. *flore albo !* and *flore carneo !* Coleshill Heath, *Bree*, *Purt.*, iii., 371 ; Coleshill Bog, *Ick. Anal.*, 1837 ; Sutton Park ; canal bank, Catherine Bridge, near Solihull ; lane by Shelly Coppice ; near Berkswell Hall, &c.

II. Canal bank and field between Bearley and Wilmcote ; with purple flowers in the Alcester and Stratford Road, near Alcester ; on the turnpike road from Warwick to Stratford.

Var. *c. oxyptera*, Reich. Very rare.

Near Honington Hall, Shipston-on-Stour, *F. Townsend.*

Var. *b. depressa*, Wender. Common on heaths and heathy footways.

I. Sutton Park, white, purple, and blue varieties ; Coleshill Heath ; Ballards Green, near Arley ; Arley Wood.

II. Yarningale Common, Kenilworth Heath, &c.

CARYOPHYLLACEÆ.

DIANTHUS.

D. Armeria, *Linn.* *Deptford Pink.*

Native : In cultivated fields and on banks. Very rare. July.

II. On a hedge-bank leading from Coughton Fields to Great Alne, &c., *Purt.*, i., 208 ; Hampton-on-the-Hill, *Perry*, 1817 ; *Herb. Brit. Mus.*, *H. B.*, 1866 ; by the side of the road from Warwick to Norton Lindsay, *Perry*, *Fl.* 40 ; Sherbourne, *Dr. Baker.*

[**D. deltoides**, *Linn.* Occurs in a semi-wild state in the Oscott College grounds, very sparingly now, but formerly abundant, *Rev. J. C.* ; Roman Camp, near Chesterton, *Spec. Herb.*, *Perry.*]

SAPONARIA.

S. officinalis, *Linn.* *Soapwort.*

Denizen or alien : On banks and roadsides. Very rare. July, August.

I. Moxhall, *J. P.*, *M. S. note Bot. Guide.*

II. Hedge-bank at Dunnington, *Purt.*, i., 208 ; Harboro' Magna, *Rev. A. Blox.*

Var. *b. hybrida*, Mill. Beausale Common, *H. B.*

[**S. vaccaria**, *Linn.* Occurred sparingly on the new railway banks in Sutton Park, 1877. It is also found on the borders of fields near Waverley Wood, abundantly, *Herb.*, *Perry*, *H. B.*, 1876.]

SILENE.

S. inflata, *Smith.* *Bladder Campion.*

Native : On dry banks in sandy soils. Rather common. June to August.

More or less abundant through the county, but often missing over wide areas. A form, with slightly pubescent lanceolate leaves, occurs near Bannersley Pool.

Var *b. puberula* is found in hedges at Morton Morrell, *H. B.*

S. anglica, *Linn.* *English Catchfly.*

Native : On railway banks. Rare. June, July.

I. Abundant on the new railway banks in Sutton Park, 1877-9.

II. Near Brandon on the London railway bank, *Kirk, Herb., Perry*; merely a casual in the county; it cannot be considered as established in either of its habitats.

[**S. nutans**, *Linn.* *Nodding Catchfly.*
Cultivated ground, very rare. A casual in the Oscott College grounds, *Rev. J. C.*]

[**S. annulata**, *Thore.*
Occurred sparingly on the new railway banks in Sutton Park, 1877, merely as a casual weed.]

S. noctiflora, *Linn.* *Night flowering Catchfly.*
Colonist: In arable land, and on railway banks. Very rare. June, July.

II. In a field near Harboro' Magna, *Rev. A. Blox;* railway banks, near Brandon, *S. Kirk, Herb., Perry;* cornfield by the Blue Boar Lane, *L. C. in. R. S. R.*, 1878; on black lands, near Ipsley! abundant. *J. T. Slatter.*

LYCHNIS.

L. vespertina, *Sibth.* *White Campion.*
Native: On banks and cultivated lands. Common. June to September. Area general.
A form occurred in 1874 at Brandon in some abundance, in which the flowers were bisexual. These flowers were all infested with one of the black smuts and were all infertile.

L. diurna, *Sibth.* *Red Campion.*
Native: On hedge banks, waysides, and in fields. Common. May to September. Area general.

L. Flos-cuculi, *Linn.* *Ragged Robin.*
Native: In marshes and on damp meadows and heath lands. Common. May to July.
Throughout the country, but more local than the above-mentioned species.

L. Githago, *Lam.* *Corn Cockle.*
Colonist: In corn fields, rarely on railway banks. Local. June to July.

I. Fields near Sutton Park; near Trickley Coppice; new railway banks, Sutton Park; Bannersley Rough, Middleton, Berkswell, Temple Balsall, Nuneaton, &c.

II. Radford Semele, *Y. and B.;* Honington, *Newb.*; Warwick; Brandon; Henley-in-Arden; Billesley, &c.

MŒNCHIA.

M. erecta, *Sm.* *Upright Pearlwort.*
Native: On damp sandy heaths. Rare. May, June.

I. Coleshill Heath! Bree., *Purt.* i., 104; Corley Moor and other like places, *Bree.*; Atherstone Outwoods, also on Annesley coalfield heath, *Rev. A. B., Phyt.* iii., 324; Coleshill Pool, 1880; Sutton Park, 1873-9.

II. Kenilworth heath and Yarningale Common! *Y. and B.*

CERASTIUM.

C. semidecandrum, *Linn.* *Mouse-ear.*
Native: On walls and dry heathy places. Rare. April, May.

I. Heathy pathways, lane from Marston Green to Bickenhill; heathy pathways above Coleshill Pool.

II. Kinwarton, in a field by the church, *Purt.* i., 221; Warwick, *Perry Fl.*; stone quarry, Warwick, *H. B., Spec. Herb., Perry.*

C. glomeratum, *Thuil.* *Broad-leaved mouse-ear Chickweed.*
Native: In fields, waysides, &c. Common. April to September. Area general.

C. triviale, *Link.* *Narrow-leaved mouse-ear Chickweed.*
Native: In arable land and on waysides and banks. Common. April to September. Area general.

C. arvense, *Linn.* *Field Chickweed.*
Native: In sandy fields and banks. Very rare. May, June.
I. Coleshill Heath; sandy field, near Packington.
II. Railway banks between Coventry and Brandon, *T. Kirk*; railway banks, near Willenhall, *Kirk*.
The Coleshill Heath plants are the pubescent variety. In this locality it is somewhat uncertain in its occurrence, being plentiful for one season and absent another, varying with the crop.

STELLARIA.

S. aquatica, *Scop.* *Malachium aquaticum*, Bab. Man. *Water Chickweed.*
Native: on damp hedge banks, borders of ditches, and in woods. Local. July to September.
I. Bradnock's Marsh, *W. B. Grove*; Erdington, Sutton, Curdworth Bridge, Knowle railway bank, Smallheath.
II. Banks of the Avon and Milverton, *Y. and B.*; by a copse at Tredington, Honington! *Newb.*; Alveston pastures, Coombe Abbey woods, Henley-in-Arden; Tile Hill, abundant.

[**S. nemorum,** *Linn.* *Wood Stitchwort.*
Is recorded as having sprung up many years in Mr. Purton's garden, Alcester, *Purt.* i., 213, notes; Warwickshire, *Brec. Catalogue, N. B. G.*, 1835.]

S. media, *With.* *Common Chickweed.*
Native: On banks, walls, waysides, fields, &c. Everywhere common. Flowering and fruiting throughout the year.
Var. *c. neglecta.* Weihe. Local.
I. Solihull, near the railway station; Lapworth.
II. Holywell, near Claverdon; Budbrook, near Warwick.
The rampant form of var. *a* often mistaken for this.
Var. *d. umbrosa*, Opitz. Apparently rare, growing in damp, sandy soils.
II. In many places by the Stour, near Honington, *Newb.*; wet, sandy places by the River Alne, Aston Cantlow; sandy lane, near Holly-berry End.

S. Holostea, *Linn.* *Greater Stitchwort.*
Native: On banks, in woods, pastures, &c. Common. April to July. Area general.

S. glauca, *With.* *Glaucous Stitchwort.*
Native: In damp or marshy sandy places. Very rare. May.
II. Leek Wootton, *Y. and B.*; sandy lane, Milverton, *H. B.*!; meadow, Hill Wootton, *Herb., Perry*; Lye Green.

S. graminea, *Linn.* *Lesser Stitchwort.*
Native: On hedge banks, in woods, fields, &c. Common. June to August. Area general.

S. uliginosa, *Murr.* *Bog Stitchwort.*
Native: In ditches, marshes, damp woods, &c. Rather common. May, July.
I. Sutton Park; Water Orton; Hartshill; Shustoke; Berkswell; Solihull, &c.

II. "Rare—Cookhill in some boggy ground," *Purt.*, i., 213; Packmore Fields, Warwick, *Perry*, *Fl.* 40; Oversley; Binley; near Newbold-on-Avon; Combe Woods, &c.

I think that this plant must have been overlooked by Purton, as I find it by no means rare in the Avon basin.

(To be continued.)

HOW TO WORK IN THE ARCHÆAN ROCKS.*

BY C. CALLAWAY, M.A., D.SC., (LOND.,) F.G.S.

The Archæan (Pre-Cambrian) rocks have recently excited considerable interest, owing partly to the more or less complete working out of the younger groups, and partly to the fascination which attends a study of peculiar complexity.

In America, six Archæan systems have been described, which, taken in descending order, are the following:—

I.—*Keweenian*, or copper-bearing series of Lake Superior.
II.—*Taconian*.
III.—*Montalban*, or mica-schist series.
IV.—*Huronian*.
V.—*Norian*.
VI.—*Laurentian*.

In Britain, Murchison recognised the Laurentian in the great gneiss series of the Hebrides, and Dr. Holl claims the same antiquity for the Malvern ridge. Salter and Hicks discovered two Archæan groups, Dimetian and Pebidian, at St. Davids. Two Archæan formations have also been recognised in Carnarvonshire, and the writer has worked out two groups in Anglesey. He has also discovered two series, a volcanic and a metamorphic, in Shropshire, and has detected the former on the flanks of the Malverns. The slaty and brecciated rocks of Charnwood Forest have also been referred to the Archæan by Dr. Hicks, subsequent to their description by Messrs. Hill and Bonney.

Notwithstanding the peculiar difficulties attending the study of these rocks, there is no reason to despair of success, and, in this paper, the methods of work are indicated.

The evidence of *organic remains* is rarely applicable. The organic nature of *Eozoon* is strenuously disputed, and, in the present state of the controversy, the (so-called) fossil is of little value as a test of age. Besides this, a similar structure has been discovered in the Taconian, and Murchison even claimed it as a Silurian fossil. The traces of annelides, which are found in some very ancient rocks, are hardly distinguishable from recent tracks and burrows, and are of little classificatory use.

The test of *order of superposition* is frequently complicated by *inversions*. In North America the Archæan rocks have a general south-east dip, but really they are made up of numerous parallel folds, with

* Summary of a paper read before the Geological Section of the Birmingham Natural History and Microscopical Society, on June 28th, 1881. Published in full in the "Geological Magazine."

their summits thrown over to the north-west. The contorted schists of Anglesey display the same phenomena. The contortions have been disentangled by the discovery by the writer of a grey gneiss underlying the prevailing green schist, and the latter is seen to lie in sharp synclinal folds between anticlines of the gneiss.

The superposition test is also complicated by *faulting*. The Archæan groups in Britain are generally brought against the Lower Palæozoic Rocks, and against each other by faults. In Anglesey and in Ireland, the ground occupied by the Archæans is almost literally a pavement of fragments. The difficulty thus arising may sometimes be surmounted by the following method. An actual example will make the matter clearer. In central Anglesey, there is a broad band of granitoid rock passing down into green schist, but as the area is margined by faults, the succession cannot be traced down lower ; but two miles to the east, we again come upon the green schist, and by following the section to the west, we find the schist is underlain by a succession of gneissic rocks. The green schist thus connects the two areas, and enables us to construct a complete succession.

The test by *included fragments* is often of great service in these old rocks. Three examples of its value are here given. The plum-coloured conglomerates of the Longmynd (Lower Cambrian), in Shropshire, are largely made up of a purple felstone, which is common in the Wrekin volcanic series, which is thus proved to be Pre-Cambrian. The Wrekin group itself contains conglomerates whose pebbles are varieties of metamorphic rock which have been derived from a series of which Primrose Hill, near the Wrekin, is a denuded fragment. The existence of two Archæan groups in Shropshire, a volcanic and a metamorphic, is thus proved. The third example is in Anglesey. Conglomerates, proved by their fossils to be Cambrian (Tremadoc), contain pebbles of organitoid rock and schist, together with rounded fragments of green and purple slate. It is clear that these conglomerates have been formed from the denudation of the two other formations which occur in the vicinity, a Gneissic and a Slaty group, both of which are thus proved to be Pre-Cambrian or Archæan.

But the test by included fragments must be used with caution. In volcanic formations there may be contemporaneous denudation, and a conglomerate may be derived from a lower part of the same series. Such conglomerates, with pebbles of purple felstone, occur in the Wrekin series, and their included fragments are of no classificatory value.

The *mineral composition* of rocks, often an important test even in fossiliferous deposits, as the chalk or the Zechstein, becomes of supreme value amongst the Archæan groups. Thus the green schist of Anglesey, as previously shown, becomes a connecting link between areas separated by faults, and is as readily recognised in any part of the island as if it contained fossils. Thus also the slaty series of Anglesey is inferred to be Pebidian, by its close mineral resemblance to the typical

Pebidian of St. David's. Indeed, this test is our chief guide amidst the complexities of these old rocks, and its use has led to some of our most interesting discoveries. Due caution must, however, be exercised in its application.

This kind of evidence decreases in value as the formations compared increase in distance. There are, for example, volcanic rocks similar to the Wrekin series, both at Pontesbury near Shrewsbury, and near Bangor. But it is obvious that the evidence for the correlation of the Pontesbury rocks with the Wrekin group,from which they are but a dozen miles distant, is incomparably stronger than the proof of the contemporaneity of the Bangor series, which is separated from the Wrekin by the breadth of North Wales.

In estimating the value of this test, it is first of all necessary to ascertain if the rocks under investigation are *older than the Cambrian.* The Charnwood slaty series, for example, can only by superposition be proved to be pre-carboniferous ; and the evidence for its Pebidian age is, therefore, much weaker than the proof adduced for the Anglesey slaty series, which is proved by included fragments to be Pre-Cambrian.

An important accessary test is *similarity of succession.* Thus the green schist on the Menai Straits closely resembles the rock underlying the granitoidite in the centre of Anglesey. But it would be just *possible,* were there no other evidence, that the resemblance was a mere coincidence. The discovery, however, of a grey gneiss under the green schist in both areas removes the doubt ; for that the similar succession should be due to coincidence is simply incredible.

In comparing formations by their mineral characters, it is requisite to take them *as a whole.* Rock specimens selected with a view to favour a preconceived theory will lead to the most bewildering results.

The *degree of metamorphism* of a rock-group is an important factor in the evidence. Recent investigations favour the conclusion that, at least in England and Wales, all metamorphosed or partially altered groups are Archæan, and that the intensity of the alteration is proportioned to the age of the series. All the cases of metamorphic Cambrian and Silurian, adduced by Murchison and others, have, on re-examination, broken down, and there would appear to be some grounds for constructing an empirical rule that, within the above limits, any new area of regional metamorphism which may be discovered would probably be Archæan. Numerous proofs of these points might be adduced, if space permitted. It is, of course, necessary in these studies to bear in mind the influence of *selective metamorphism.* A quartzose rock, for example, can undergo little change; whereas a felspathic rock, though of less antiquity, might be intensely metamorphosed. We must also carefully distinguish between *regional* and *contact* metamorphism. The presence of the latter would be of no assistance in our work.

In correlating Archæan groups, it is important to ascertain the *origin* of the deposits ; whether, for example, the rocks were sedimentary or volcanic, or both. If successful in this point, we narrow the issue to be decided.

The *microscope* is of great value in these investigations. It gives precision to field-work, and discovers facts which field tests are not competent to ascertain.

The *strike* of a series has often been used as an aid in correlation, and, within due limits, it decidedly adds to the weight of other evidence.

In conclusion, it is to be observed that in Archæan work the proof is generally *cumulative*. Results are often obtained by the accumulation of minute facts, most of which cannot be published, or even recorded without incalculable labour. Each tap of the hammer helps to build up the conclusion. Different lines of evidence, each of which taken alone would fail to convince, converge towards the final issue. *Thorough* and *detailed* labour is above all necessary. With patience and zeal there is no reason why the Archæan fields of work, barren as they appeared to our predecessors, should not yield most fruitful additions to our knowledge of the early history of the globe.

MIDLAND UNION OF NATURAL HISTORY SOCIETIES.

The following particulars of the several Societies in the Union formed part of the Council's Report presented at the Cheltenham Meeting, held June 16th, 1881:—

The Banburyshire Natural History Society and Field Club was formed on the 7th of March last. On the 1st of May it numbered seventy Members, paying a subscription of 5s. annually. It meets at Banbury on the first Monday in each month; it has arranged for excursions occasionally during the summer months. Nine papers have been read before the Members during the past three months. Mr. T. Beesley, F.C.S., High Street, Banbury, is the President, and Mr. E. A. Walford, 21, West Bar Street, Banbury, the Hon. Sec.

The Bedfordshire Natural History Society and Field Club was founded in 1875. It consists of 86 Members, who pay a subscription of 5s. per annum. Meetings are held on the second and fourth Thursdays in every month, the former being ordinary meetings, and the latter microscopical. Excursions are made frequently during the summer months. During the year eight papers have been read before the Society. The Botanical Section is engaged in preparing a new *Flora Bedfordiensis* and a large number of the rarer flowering plants have been collected and arranged in a herbarium. The Society has published its Transactions for the years 1875-7: the publication of those for the past three years has been unavoidably postponed. The Society has no President. Mr. Thomas Gwyn Elger, F.R.A.S., is the Honorary Secretary.

The Birmingham Microscopists' and Naturalists' Union dates from June, 1880. It has about 40 Members, who pay a subscription of 5s. per annum. It meets weekly, and has half-holiday excursions about every three weeks during the summer months. On Bank Holidays it has whole-day excursions. Nineteen papers have been read before the Society; two lectures have also been delivered. At several Meetings special branches of Microscopy have been studied, and much mutual help has been afforded by practical illustrations in mounting, hints on the collection and preparation of various objects of Natural History, and exhibition of apparatus. A record of birds seen in the district has been commenced. A Botanical Section has undertaken to press and mount for preservation all new specimens which may be brought from time to time, or that may be found in the course of the excursions. The Meetings of the Society have stimulated Microscopical research. The Society has not yet published any Report of its proceedings. Mr. J. W. Oliver, 271, St. Vincent Street, Birmingham, is the President; the Honorary Secretaries are Mr. H. Hindmarsh, 26, Gough Road, Birmingham, and Mr. H. Insley, 19, Tenby Place, Prescott Street, Birmingham.

The Birmingham and Midland Institute Scientific Society was founded November 15th, 1872. Its meetings are held every Wednesday at the Midland Institute. It numbered 162 Members on 1st January last, being an increase of twenty-five during the year. The annual subscription is 3s. Its Members are chiefly former and present students at the Institute. Excursions take place monthly. Nineteen papers have been read before the Society during the past twelve months. The Society does not publish an Annual Report. The President is Mr. R. Hipkiss, Lifford Cottage, Lodge Road, Birmingham; the Hon. Sec. Mr. W. H. Cox, 150, Newhall Street, Birmingham.

The Birmingham Natural History and Microscopical Society was founded in 1858, under the title of "The Birmingham Natural History Association." In 1861 it was reconstructed, and its present name adopted. On the 1st January last the Society consisted of 371 Members, 327 paying 10s. per annum, 34 Honorary and 10 Associates who are youths between the age of 14—19, with a decided taste for Natural History pursuits, elected after careful investigation, who enjoy, without payment, all the privileges of the Society (except that of voting) until they attain the age of 19. The number of Associates is limited to 20. Meetings are held every Tuesday evening throughout the year at Mason's College, and during the winter months on Friday evenings also, when sectional meetings are held and much useful work done. During the summer excursions are made on an average twice a month. A notable feature of this Society's operations is an occasional marine excursion, lasting from ten days to a fortnight. In 1873 Teignmouth was visited; in 1877 and 1878 Arran; and in 1879 the members went to Falmouth; the marine excursion for the present year will be to Oban. The party leaves Birmingham on the 1st July, and will stay about 12 days; the estimated cost is £12 12s. per head. The Society generously invites members of other Societies in the Union to join in these pleasant excursions. Past experience has proved the acceptableness of this arrangement and many pleasant friendships have been formed. During the past year 29 papers have been read before the Society, some of them detailing valuable original work. Among the special work done by Members, the investigation of the Flora of Warwickshire by Mr. J. E. Bagnall, Hon. Librarian of the Society, must be specially mentioned. The Flora is in course of publication in the journal of the Union, and when completed, promises to be a most valuable addition to botanical literature. Mr. A. W. Wills has made several additions to British Desmids, and is engaged on the study of this family generally. Messrs. Allport and Crosskey have been engaged in special geological work. Mr. J. Levick, whose papers on Pond Life, in the "Midland Naturalist," have made his name familiar to many Members of the Union is pursuing his researches; and Mr. W. G. Blatch is making a special study of the Coleopterous fauna of the district. The most important event of the year was the removal of the Society's quarters from the Midland Institute to the Science College, generously founded and endowed by Sir Josiah Mason, Kt., where the Society has had a private room assigned it in which its valuable library and instruments are kept, and which is open for the use of the Members (who largely avail themselves of the privilege) several hours daily. The ordinary weekly meetings of the Society are held in the Biological Theatre of the Mason College. The Society publishes an Annual Report. In the month of April in the present year, it published a volume of Transactions, in which were reprinted all the papers read before the Society during 1880, which had been printed in the "Midland Naturalist"; the illustrations, which had been nearly all drawn by the authors of the respective papers, were also reproduced. Mr. Edward W. Badger, *Herald Office*, Union Street, Birmingham, is the President; Mr. John Morley, 24, Sherborne Road, Birmingham, and Mr. W. B. Grove, B.A., Franchise Street, Perry Barr, Birmingham, are the Honorary Secretaries.

THE BIRMINGHAM PHILOSOPHICAL SOCIETY was founded in 1876. It now numbers 154 Members, and the subscription is one guinea per annum. Meetings are held monthly; extra meetings are also held occasionally. Eight papers and several notes, on scientific subjects, have been read before the Members during the past year. The Society has an invested fund for the endowment of original research, of which details were given in the report presented by your Council at the last annual meeting of the Union. The Society publishes Transactions, and a Report annually. The President is the Rev. H. W. Watson, Berkswell, Coventry, who has recently been elected a Fellow of the Royal Society. The Honorary Secretaries are the Rev. H. W. Crosskey, F.G.S., George Road, Edgbaston, Birmingham, and Mr. R. Levett, M.A., Moseley, near Birmingham.

THE BIRMINGHAM SCHOOL NATURAL HISTORY SOCIETY was started in 1869. It consists of 4 Honorary Members, and 43 paying an annual subscription of 4s. The Society is divided into Biological and Geological Sections, the latter at present existing only in name. The Biological Section was at the last Annual Meeting divided into Zoological and Botanical Sub-sections. General Meetings of the Society are held every other Friday; the Botanical and Zoological Sub-sections hold their Meetings on alternate Mondays. The Meetings are held in the School Museum after afternoon school. An annual excursion is made by the Society, generally in May, and sometimes Saturday afternoon excursions are made during the summer months. The President is the Rev. A. R. Vardy, M.A., Head Master of the school. Mr. A. E. Wynne is Honorary Secretary.

(To be continued.)

MINERALS OF THE MIDLANDS.

BY C. J. WOODWARD, B.SC.

(Continued from page 186.)

GLOUCESTERSHIRE.

I am indebted to Mr. W. C. Lucy, F.G.S., of the Cotteswold Club, for information he has collected respecting the minerals of this county. Mr. Lucy sends me the following replies he has eceived to his enquiries.

From Mr. W. Blanch Brain, of Cinderford.

"The principal mineral in the Forest of Dean is the red hæmatite iron ore, which is found in lodes, locally termed churns, and contained in a rock which is called by the miners the Creese Stone, and is situated above the Mountain Limestone. This ore is extremely valuable for steel making, being perfectly free from phosphorus. It is to be found in the lower basin of the forest, which extends throughout the forest, and can be seen to the best advantage at the following mine works, viz., Wigpool, Edge Hills, St. Aundls, Buckshaft, and Stidkemantel.

"There are some argillaceous ores, which occur in the coal Shales, but these have not been worked to profit to my knowledge. They are to be found in small quantities at almost every colliery in the forest.

"I should have said that at the St. Aundls Mine Works, before alluded to, there is found with the red hæmatite iron ore a beautiful ochre.

"In our lowest coal seam, called the Hildelph vein, there has been found a small quantity of lead, yielding a small percentage of silver.

"A quantity of Iron Pyrites (locally termed "Dogs," because they form blocks, like stone) is to be found in a vein of coal named the "Twenty Inches." The Pyrites is very detrimental to the coal, (being very heavy, and has to be cut out,) and the former is insufficient to guarantee a manufacture of sulphur, although such a process has been contemplated.

"The above, together with the several veins of coal, I believe, constitute the whole of the mineral commercial products of the Forest of Dean, with the exception of an excellent Fire Clay, which is found just above the Hæmatite series.

"I think our firm is the only one which manufactures fire bricks from that clay in connection with our pottery.

"Our clays are rich in aluminium, and I have struggled hard to extract it on a cheap principle by means of an electrical furnace, (before Dr. Siemens introduced his,) but have hitherto only partially succeeded.

From Mr. Henry Fryer, of Coleford, the following list of

MINERALS FROM THE FOREST OF DEAN.

Calcite	Iceland Spar	Mountain Limestone.
,,	Stalactite	Mountain Limestone.
,,	Satin Spar	Mountain Limestone.
Dolomite		,,
Quartz		,,
,,		Millstone Grit.
Mica		Upper Beds Old Red Sandstone.
Iron Pyrites		Coal Measures.
Brown Hæmatite	Gœthite, Limonite	Mountain Limestone.
Wad	Impure Binoxide of Manganese	Millstone Grit.
Calamine		Coal Measures.
Galena		Coal Measures.

RHÆTIC.

Gypsum	Westbury Cliff.
Iron Pyrites	,,

From the Rev. Dr. Smithe (proceedings of the Cotteswold Naturalists' Field Club).

TORTWORTH AREA.

Damory Bridge.

Hornblendic Trap Rocks	Fine grained serpentinous Greenstone-Diorite .. ..

Charfield.

Diorite Amygdaloidal	Cavities filled for most part with Calcite, many lined with a green zeolitic mineral called Viridite .. ..

From Mr. Edward Wethered, F.G.S. :—

MINERALS FROM THE NEIGHBOURHOOD OF BRISTOL.

Name of Mineral.	*Locality.*	*Geological Formation.*
Hæmatite ..	Clifton, Winford, Ashton, Frampton-Cottrell ..	Dolomitic conglomerate, where it is in contact with the Limestone. Forms workable deposits in the fissures of the Pennant Grit of the Middle Coal Measures at Frampton-Cottrell.
Malachite ..	Clevedon, Somersetshire	Dolomitic conglomerate, only in small quantities.
Galena	Mendips, Clevedon, Somerset, Shirehampton.. ..	In Dolomitic conglomerate and Mountain Limestone.
Celestine, massive and crystalline ..	The crystalline variety at Clifton. The massive variety in the neighbourhood, at Bedminster, &c.	In Mountain Limestone cavities. In oval or round masses, at the bottom of the new Red Marl.
Barium in the form of heavy spar (Sulphate of Barium) ..	At Clifton and the neighbourhood ..	New Red Marl.
Baryto-Celestine, recently discovered, the only known place in England	Clifton, in the Oakley Road, when digging foundations for buildings ..	New Red Marl.
Calcite ..	Clifton	In the cavities of the Mountain Limestone.
Quartz, massive and crystalline, chiefly the latter, known as "Bristol Diamond" ..	Clifton .. .. Kingswood	Dolomitic conglomerate. Coal Measures (Lower) in nodules of clay ironstone.
Gœthite (or hydrate of iron)	Sion Hill, Bristol..	Dolomitic conglomerate
Ironstone Nodules or Blackband Ironstone	Easton, Bedminster, Kingswood (suburbs of Bristol)	Lower Coal Measures.

Coal.		
House Coal ..	Pucklechurch .. Yate, Kingswood .. Easton, Bedminster	Upper Coal Measures. Middle and Lower. Lower Coal Measures.
Gas Coal ..	Pucklechurch ..	Upper Coal Measures.
Steam Coal ..	Yate, Kingswood, Easton, Bedminster	Lower Coal Measures.
Brick Earths ..	Kingswood .. .. Bedminster	Recent. New Red Marl.
Fire Clay ..	Pucklechurch, Kingswood, Yate, Easton, Bedminster	Coal Measures.
Dolomite ..	Clifton, Clevedon ..	Trias.
Silver, Traces of	Mendips, Clevedon, Shirehampton ..	In the Dolomitic conglomerate and Limestone, associated with the Galena.
	Walton	In the free state in Carboniferous Limestone.
Gold, Traces of	Walton	Carboniferous Limestone.
Manganese ..	It is difficult to define special locality, as it is to be found in most rocks, especially the Carboniferous	Carboniferous, Trias.

The two last metals were discovered by the late Mr. Stoddart. See paper read before the Bristol Naturalists' Society, Vol. II., part 1, 1876-77, new series. Mr. Stoddart was so good a chemist that I think there can be no doubt as to the truth of his statement. In 100 parts of the Limestone he found ·003 of silver. Mr. Merry, of Swansea, has verified Mr. Stoddart's observations as to gold. He found three grains per ton.

METEOROLOGY OF THE MIDLANDS.

THE WEATHER OF JULY, 1881.

BY CLEMENT L. WRAGGE, F.R.G.S., F.M.S., ETC.

[Up to the time of going to press we have only received Mr. Wragge's collation of the reports of his band of observers contained in the following Table. Mr. Wragge's arduous exertions in connection with the daily meteorological observations which he is making on Ben Nevis occupy a great deal of time; and to this cause, it is no doubt due, that the usual monthly summary (for July) has not come to hand in time for presentation to our readers in regular course.—Eds. M. N.]

STATION.	OBSERVER.	RAINFALL.				TEMPERATURE.			
		Total for M.	Greatest fall in 24 hours.		No. of rainy d.	Greatest ht.		Greatest cd.	
		In	In.	Date.		Deg	Date.	Deg	Date.
OUTPOST STATIONS.									
Ben Nevis *(a)*	C. L. Wragge, Esq., F.M.S.	15·1	1·91	3	31	50·2	5	28·[illegible]	21
Fort William *(a)*	C. L. Wragge, Esq., F.M.S.								
Spital Cemetery, Carlisle	I. Cartmell, Esq.	4·01	·90	5	17	78·7	6	39·2	21
Scarborough *(a)*	F. Shaw, Esq., F.M.S.	3·92	1·29	[illegible]	11	[illegible]	11	47·[illegible]	21
Blackpool *(a)*—North Shore	C. T. Ward, Esq., F.M.S.	4·54	1·51	5	16	76·8	5	47·3	27
South Shore						74·5	5	49·4	27
Llandudno *(a)*	J. Nicol, Esq., M.D., F.M.S.	3·47	1·80	5	12	74·8	4	47·6	9
Altarnun, Cornwall	Rev. J. Power, M.A.	3·92	1·12	29	15	84·0	6 & 19	37·0	28
Sidmouth *(a)*	D. Radford, Esq.	2·06	·65	5	13	77·8	16	44·8	28
Ramsgate *(a)*	Rev. T. E. Egan, O.S.B.	0·98	·28	5	10	84·7	19	48·0	7
MIDLAND STATIONS.									
GLOUCESTERSHIRE.									
Stroud	S. J. Coley, Esq.	2·16	·72	31	11	83·0	6	41·0	27 & 28
Cheltenham *(a)*	R. Tyrer, Esq., B.A., F.M.S.	1·90	·44	5	14	86·8	5	35·8	28
WILTSHIRE.									
Marlborough *(a)*	Rev. T. A. Preston, M.A.	2·14	·69	30	13	87·1	15	36·2	28
SHROPSHIRE.									
Woolstaston	Rev. E. D. Carr	1·14	·25	23	13	83·5	5	44·5	7 & 21
Stokesay *(a)*	M. De La Touche	1·36	·29	30	13	86·5	5	38·[illegible]	28
More Rectory, Bishop's Castle	Rev. A. Male	1·22	·27	5	15	86·0	5	40·0	21
Bishop's Castle	E. Griffiths, Esq.	1·30	·26	30	14	88·0	5	41·0	21
HEREFORDSHIRE.									
Stoke Bliss	Rev. G. Alexander	1·40	·70	5	10	84·0	5	44·0	27
WORCESTERSHIRE.									
Orleton, Tenbury	T. H. Davis, Esq., F.M.S.	1·47	·48	5	13	87·7	5	37·0	28
West Malvern	A. H. Hartland, Esq.	1·63	·50	5	10	93·5	5	45·0	20 & 27
Evesham	T. J. Slatter, Esq., F.G.S.	1·47	·31	6	14	86·8	5	43·3	28
Bewdley	J. M. Downing, Esq.	1·71	·77	6	10	94·0	15	33·0	28
Pedmore	E. B. Marten, Esq.	1·60	·36	26	12	92·0	5 & 15	41·0	27
Stourbridge	Mr. I. Jefferies	1·68	·49	26	12	87·0	5	40·0	27
Dudley	Mr. C. Beale	1·61	·28	6	13	83·0	5	44·0	29
STAFFORDSHIRE.									
Dennis, Stourbridge *(a)*	C. Webb, Esq.	1·28	·43	5	14	88·0	5	43·5	31
Kinver	Rev. W. H. Bolton	1·32	·32	6	13	86·0	5	41·0	27
Walsall	N. E. Best, Esq.	1·61	·52	5	12	79·0	5	46·0	27
Lichfield	J. P. Roberts, Esq.	1·80	·55	6	12	94·0	6	44·0	8
Grammar School, Burton	C. U. Tripp, Esq., M.A.	1·24	·21	24	14	91·0	5	39·0	28
Weston-under-Lyziard	Hon. & Rev. J. Bridgeman	2·18	·80	5	13	93·0	5	42·0	28
Wrottesley *(a)*	E. Simpson, Esq.	1·49	·47	6	11	87·7	5	42·5	28
Heath House, near Cheadle *(a)*	J. C. Philips, Esq., J.P.	2·16	·80	26	14	82·0	5	44·2	28
Oakamoor *(a)*	Mr. E. E. Kettle	2·27	·65	26	11	84·9	5	36·8	28
Beacon Stoop, Weaver Hills *(a)*	Mr. James Hall								
WARWICKSHIRE.									
Park Hill, Kenilworth	T. Hawley, Esq.	1·73	·48	6	11	87·5	5	40·7	28
Coundon, Coventry	Lieut.-Col. R. Caldicott	2·12	·45	26	14	88·0	5	45·0	27
DERBYSHIRE.									
Stony Middleton	Rev. U. Smith	2·34	·88	5	12	82·0	5 & 15	41·0	20
Spondon	J. T. Barber, Esq.	1·25	·25	5	12	85·0	5	40·0	20
NOTTINGHAMSHIRE.									
Park Hill, Nottingham	H. F. Johnston, Esq.	1·84	·41	26	11	84·5	5	47·5	20
Hodsock Priory, Worksop *(a)*	H. Mellish, Esq., F.M.S.	1·24	·31	6	11	85·7	5	[illegible]	21
Tuxford	J. N. Dufty, Esq., F.G.S.	1·48	·27	[illegible]	12	81·0	5	44·0	20
LEICESTERSHIRE.									
Loughborough *(a)*	W. Berridge, Esq., F.M.S.	1·30	·29	8	15	89·7	5	43·1	28
Syston	J. Hames, Esq.	1·25	·38	6	10	87·0	5	44·0	28
Ashby Magna	Rev. Canon Willes	1·65	·38	6	13	88·0	5 & 15	41·0	28
Kibworth	F. Macaulay, Esq.	2·28	·69	30	14	86·0	5	42·0	7
Waltham-le-Wold	E. Ball, Esq.	1·89	·60	6	12	86·0	5	46·0	7
Coston Rectory, Melton *(a)*	Rev. A. M. Rendell	2·05	·60	6	14	85·1	5	40·0	28
NORTHAMPTONSHIRE.									
Towcester	J. Webb, Esq.	3·11	1·17	6	12	92·0	5	40·0	27
Kettering	J. Wallis, Esq.	3·65	1·37	30	14	83·0	6	47·0	28
RUTLAND.									
Northfields, Stamford	W. Hayes, Esq.	3·98	1·37	6	11	86·0	19	38·0	28

(a) At these Stations Stevenson's Thermometer Screen is in use, and the values may be regarded as strictly intercomparable.

Correspondence.

Scarcity of the Starling.—There has been here this season a wonderful scarcity of starlings. For some years past there were always three or four nests on these premises alone, and many more in the trees and buildings near at hand, whereas this season I have not seen one, nor do we see the small flocks, composed of the young broods, frequenting the fields as was formerly their custom at this time of year. The winter of '79-80 seemed to have very little effect on them, and after last winter there appeared to be a fair number about, so I do not think that the severe weather can alone account for their decrease. Have any of your readers noticed a similar diminution of numbers—I may almost say extinction of the species—in their neighbourhood? It is the more surprising, insomuch as the winter flocks of this bird have greatly increased during the last few years.—Oliver V. Aplin, Bodicote, Oxon., August, 1881.

Migratory Birds (see "Midland Naturalist," page 186).—In my notes on Migratory Birds the date of arrival of the Willow Wren should have been 13th not 18th.—O. V. A., Bodicote, Oxon.

Microscopic Slides.—At the recent Exhibition of the Beekeepers' Association, at South Kensington, our correspondent, Mr. F. Enock, 30, Russell Road, Seven Sisters' Road, London, carried off the silver medal offered for the best microscopic slides illustrating the natural history of the honey bee. The slides were four dozen in number, and, says the "Journal of Horticulture," "if not unapproachable are certainly as yet unapproached. The preparation of parts *in situ* without pressure gives an opportunity of examining structure that flattened chitine could never afford. The beauty of these objects when properly illuminated must be seen to be appreciated. On some slides he brings side by side the homologous parts of drone, worker, and queen, which gives a ready means of comparison, and on others displays the parts illustrative of the complete anatomy of the insect. Some clever sections and some specimens of the interesting parasite *Stylops Spencii* were included in the collection."

British Glacial Action.—At this season, when so many persons are travelling in Wales and elsewhere, I wish to call attention to a particular instance of former Glacial Action, which came specially under my observation in June last, when staying at Ffestiniog: an example well-known to many Geologists, but which travellers may frequently miss, or fail to notice should they pass that way. Looking up at Moel Wyn from the east or south, it is apparent great forces have been at work in former ages, reducing its mass, altering its form, and leaving those grand precipices, so rugged and broken, partly enclosing its vast hollows like walls. If you walk up from the mining village of Tan y Grisiau into Cum Orthin, the great recess or glen lying between Moel Wyn and Yr Allt Mawr, the evidences of former Glacial Action are most apparent as you stand and survey the scene, especially at the outlet of the glen, where the ice for unknown time must have poured over the rocks. On either hand, and far up the spurs of Moel Wyn, most distinct and some really beautiful forms of ice-planed rocks are to be seen ; so well preserved, that one could almost imagine the ice had not long melted ! The peculiar wavy lines, the rounded and softened contours, the great grooves mostly straight, and general smoothened surfaces, so characteristic of Glacial energy, long continued across hard rocks, are all there to be studied in a most marked degree. Moreover, far up above, shewing the great thickness of the ice, some large blocks are to be detected, perched in most "precarious positions," that would be almost impossible (so near the cliff edge are they) to rock fragments detached from high positions on the steep mountain side by ordinary action of weather; but which indicate the relics left by the retreating ice when the last Glacial Epoch gave way to a milder climate. As confirming such former condition of things at this spot, down below from among stones thrown out for building purposes, from under a layer of peat, I picked up a large stone finely *striated* in the usual characteristic manner. So marked are these features in Cum Orthin, below the deep lake there partly cliff-bound, which adds much to the scenery of that wild spot, I can strongly recommend them to any student of former Glacial Action in these Islands.—HORACE PEARCE, F.G.S., Stourbridge, August, 18th, 1881.

Reports of Societies.

BIRMINGHAM NATURAL HISTORY AND MICROSCOPICAL SOCIETY.—August 2nd. Mr. Bolton exhibited *Bacillaria paradoxa*, from the Birmingham Canal, near Albion Station. This species was reputed to be confined to brackish water. Mr. Bagnall exhibited *Euonymus Europæus*, and *Lathyrus sylvestris*, from Chesterton Wood; *Samolus Valerandi* and *Trifolium fragiferum* from Itchington. Mr. J. H. Pumphrey exhibited *Epipactis latifolia*, *Verbena officinalis*, *Erigeron acris*, *Pyrus mitis*, and *Chlora perfoliata*, from Symond's Yat. Mr. W. J. Harrison exhibited a drawing of a plate of ivory, on which the outline of a mammoth had been sketched by some pre-historic man. Mr. Grove exhibited *Polyporus igniarius*, "the rusty-hoof Polyporus," from near Temple Balsall. Mr. Harrison presented six, and Mr. Parsons twenty-four, slides for the Society's cabinet.—August 9th.—BIOLOGICAL SECTION. Mr. T. Bolton exhibited *Actinophrys viridis*.—August 16th. Mr. Wagstaff exhibited a slide of *Volvox globator*, showing the yellow resting-spores. Mr. Bolton exhibited *Bowerbankia imbricata*, *Pedicellina cernua*, *Syncoryne frutescens*, and *Clytia Johnstoni*, from Brighton. Mr. Levick exhibited numbers of *Leptodora hyalina*, from the Warwick Canal, within four miles of Birmingham. Mr. W. R. Hughes exhibited the following marine animals, dredged by the Society at Oban in July last, and still living:—(Zoophyta,) *Sagartia viduata*, the snake-locked anemone, *Caryophyllia Smithii*, the Devonshire cup-coral; (Polyzoa,) *Alcyonidium hirsutum*, the stag's-horn polype; (Brachiopoda,) *Terebratula caput-serpentis*, the lamp-shell; (Gastropoda,) *Turritella communis*, and *Aporrhais pes-pelicani;* the eggs of *Lepidogaster bimaculatus*, the two-spotted sucking-fish, on a valve of Pecten; and several living specimens of Barnacles. He also described the method by which he had preserved them alive for so long, without the convenience of a marine aquarium.—August 23rd.—GEOLOGICAL SECTION. Mr. W. J. Harrison, F.G.S., in the chair. Mr. Wagstaff exhibited *Lophopus crystallinus*, and *Batrachospermum moniliforme;* Mr. J. Bagnall, *Chara fœtida*, var., *papillata*, *Arctium minus*, *Carduus eriophorus*, *Agaricus infundibuliformis*, and (for Mr. C. E. Crick,) *Silene noctiflora;* Mr. W. H. Jones, *Woodsia alpina*, from Norway; and Mr. W. H. Wilkinson, the *Rose Bedeguar*. A paper by Mr. W. Linford of Exeter, was read, descriptive of the remarkable pebble-bed at Budleigh Salterton, on the South Devon coast. The pebbles appear to have been derived from certain rocks which occur in Normandy, or from an extension of those rocks under the English Channel. Similar pebbles occur in countless numbers round Birmingham, but from what rock the latter specimens have been derived is still unknown.

BIRMINGHAM MICROSCOPISTS' AND NATURALISTS' UNION.—July 4th.—A meeting, at which was exhibited, by Mr. Boland, eleven varieties of shells from canal, Hatton; Mr. Dunn, pollen of Œnothera. A paper was read by Mr Madison on "The Oolitic Formation and its Fossils." After describing the rocks met with in the formation, a large number of fossils were shown, among which were good specimens of Echinus from the Cotteswold and Northamptonshire Oolites; also, fossil wood from Portland. July 9th.—An excursion to Habberley Valley. Large number of plants of *Potentilla fragariastrum*, found infested with *Aregma obtusatum*. July 11th.—A meeting devoted to special systematic Botany. Plants belonging to various natural orders common to the district were shown and described. Mr. Madison exhibited a variety of shells found in Habberley Valley. Mr. Betteridge exhibited a pair of Red-back Shrikes, from King's Norton; Mr. Sanders, Comma Butterfly, taken at Sparkbrook. July 18th.—A meeting, Microscopical and general. Mr. J. W. Neville exhibited spores and elaters of Marchantia; Mr. Moore, hairs of Arctic Fox and Polar Bear; Mr. Grew, Burnished Brass Moth, found in Smallbrook Street, Birmingham; Mr. Darley, Wood Tiger, Scalloped Shell, Buff Arches, and Dark Arches Moths; Mr. Betteridge, Garden Warbler, Wood Wren, Redstart, Whinchat, and Spotted Flycatcher. July 25th.—A meeting, at which Mr. Blay showed Red Crag Fossils, from Walton-on-the-Naze; Mr. Sanders exhibited varieties of Heath Moth; Mr. F. Shrive, shells from Northampton. A paper was read by Mr. Boland on "Our Common Shells and where to find them." A large number of shells, found in the district by the writer, were exhibited. Palate of *Limnæa stagnalis*, *Carychium minimum*, and Love Darts of *Helix nemoralis* were also exhibited.

OXFORDSHIRE NATURAL HISTORY SOCIETY.—The last excursion of the summer term was made to Bagley Wood, by permission of the Bursar of St. John's College. The weather was delightfully fine, and a very pleasant field day was enjoyed, although, from the multitude of attractions in the city, the attendance was not so large as could be desired. Mr. H. Boswell appeared for the Bryologists, Mr. H. Plumptre, of Univ. Coll, Entomology, Mr. G. C. Druce for Botany. The plants found included the pretty and rare Ivy-leaved Campanula, (*Wahlenbergia hederacea*,) *Rosa Borreri*, *Carex flava*, *Carex pallescens*, and *Potentilla procumbens*, and the mosses *Sphagnum cymbifolium*, *Aulacomnium palustre*, *Fissidens bryoides*, and *Hypnum commutatum*. The greasy pearl bordered and small pearl bordered Fritillaries were also seen. On January 12th a meeting was held in the University Museum, Prof. Westwood, F.L.S., presiding. Mr. H. Macpherson, of Oriel College, read a paper on "The Goldfinch," which will be printed in a future number. Prof. Westwood exhibited living specimens of the Asparagus Beetle, in order to draw attention to the sounds made by them. Two distinct noises were heard when the box in which they were contained was sharply tapped. The Professor suggested the probable manner by which the sounds were produced.—Mr. Bolton King, of Balliol College, described a visit to Grimes Bank or Dyke, near Wallingford, and stated it was almost the sole piece of original turf left on the Oxfordshire side of the river. On it he had found *Senecio campestris*, *Juniperus communis*, *Polygala calcarea*, in splendid patches; *Hippocrepis comosa*, and *Sedum Fabaria*; and at the extreme end, near the woods, *Saxifraga granulata*. In the fields near he had also gathered *Fumaria Vaillantii*, *densiflora* and *parviflora*. Mr. F. T. Richards, M.A., Trinity College, stated he had also seen *Spiræa filipendula*, *Campanula glomerata*, and *Ligustrum vulgare*, on the same bank; and Mr. Druce added to these *Monotropa hypopitys*, which grew at the western end. Mr. G. C. Druce read a note on the occurrence of *Littorella lacustris* in Oxford, which he had found in company with Mr. Richards, on Woodcote Heath, in a pond, the first record of the plant in Oxon. Another pond in the vicinity contained *Peplis portula* and *Ranunculus truncatus*, while a third and deeper one, nearer Goring, contained *Potamogeton serratus*, of Hudson. Prof. Westwood made some remarks on the various papers, and complimented Mr. Macpherson on the thoroughness of his work, as exemplified in the paper on the Goldfinch.

THE GOLDFINCH.*

BY H. A. MACPHERSON.

The European Goldfinch, *Carduelis elegans*, has been chosen for the subject of my paper ; not because I have any hope of producing many new facts on a theme so well worn as the history of this popular bird, but simply because a general account of the economy of one of our English species must comprise many of the general characteristics of the family to which it belongs.

The true finches, *Fringillidæ*, have only nine primary quills, and are divided by Bowdler Sharpe into the wide-palate finches, *Amplipalatales*, and those with narrow palates, *Arctipalatales*. To the second section, Sharpe refers the sub-families of Dresser, *Loxiinæ* and *Emberizinia*, comprising the crossbills and the buntings. The first section, composed of the sub-family *Fringillinæ*, with the bullfinches from the *Loxiinæ*, is headed in Dresser's classification by the goldfinch, followed by the citril, finch, siskin, serinfinch, greenfinch, hawfinch, sparrows, chaffinches, and linnets, all approximating to the goldfinch and to one another in various degrees of homologous structure. The sub-family *Fringillinæ* has an extensive range throughout the Palæarctic or northern geographical region of the Old World ; in the Nearctic region it is represented by the redpoles and other forms.

But wide as is the distribution of the siskin and of some other finches, the range of a few of the family is very limited. Thus the serinfinch, *Serinus hortulanus* does not appear to be really a common bird in any part of Europe except the Spanish Peninsula, though it does exist locally in France, Italy, and Germany. Since the first capture of this bird on the South Coast of England was effected, some twenty odd years back, several examples would appear to have been netted near Brighton. The male specimen now existing in the Radcliffe Museum was professedly netted near Great Yarmouth in 1877, together with a female, which won her liberty by her extreme timidity and restlessness. I need not trouble you with further details on this point to-day. I will only say that if any members should hear of " Spanish " singing finches, they will do well to enquire whether or not the serinfinch is passing under that name, as it did in Shoreditch last summer. The hawfinch is another member of the family that has increased its northern and western range of late years, though supposed, from its shy habits and woodland haunts, to be considerably more rare than is in reality the case. But the head of the *Fringillinæ*, which I want you to consider chiefly to-day, is the goldfinch, *Fringilla carduelis* of the eighteenth, *Carduelis elegans* of the nineteenth centuries.

It may be as well to notice that the bird for which Linnæus accepted the former title, is actually identical with the species he had in view; in the case of the bullfinch and nuthatch, the birds

*Read before the Oxfordshire Natural History Society on the 12th January, 1881.

before Linnæus were distinct from our insular forms. A large proportion of the names, ancient and modern, assigned to the goldfinch bear special reference to its subsisting, partially, on thistle seeds. To go back no further than Augustan literature, we are all familiar with Virgil's allusion to the goldfinch, together with the kingfisher, in the third Georgic. The generic term *Carduelis*, the French name *Chardonneret*, obviously owe their origin to the same habit. Brachet says, "chardonneret, que l'ancien français appelait chardonnet, proprement oiseau qui recherche les chardons. Ce qui confirme cette origine, c'est que les Latins disaient de même carduelis, dérivé de carduus (chardor); les Grecs ἀκανθις de ἀκανθος (acanthe; plante epineuse); enfin les Allemands appellent le chardonneret *Distelfink*, proprement linotte de chardon."—*Dictionnaire Etymologique*, page 126.

But the popular names of the goldfinch, in England at any rate, point rather to our enjoyment of its bright, well-blended colours. Thus, it is the "foolscoat" of Sir T. Browne. Nicholas Cox, in his "Gentleman's Recreation," tells us that it is also known in Norfolk as the "Christmas fool;" whether from its being easily captured about homesteads in severe frost, or from its gay tints harmonising well with the pageantry of Christmastide, members may decide for themselves.

The word finch, applied to the goldfinch amongst other members of the family, owes its origin to the monosyllabic 'pinc' of the chaffinch, which recurs in the French form *pinson*, of which Brachet says, "anciennement pinçon, diminutif d'un radical *pinc*, qui est d'origine celtique (kymri pinc, pinson)." The form 'spink' attached to the syllable gold in Scotland, exists in Early English as a synonym for the chaffinch, the goldfinch being at the same time distinctly so-called. I am not aware that any English name has been conferred on the goldfinch, from its call-note, as Mr. Dresser, in his "Birds of Europe," points out, has been the case in Norway, in Sweden, and in Germany, where the goldfinch is called *stillids*, *stiglitsa*, and *stieglitz* or *zeisig* respectively; the cry or call of "pick, pick, pickelmik," being most commonly uttered when the finch is displaying its rapid, jerky flight at some elevation. The Anglo-Saxon love of training small birds to draw their water, &c., resulted in the goldfinch being termed the "draw-water" in some districts, though the siskin, the lesser redpole, the greater titmouse, learn the trick with greater readiness. Even the hawfinch is sometimes thus educated by Spitalfields bird fanciers, whose draw-water boards are identical, to the best of my recollection, with one figured in Wright's work on Anglo-Saxon life.

The Staffordshire name for the goldfinch of "Proud Tailor," is derived, I fancy, from the rudder-like motion of the tail of this finch during the breeding season. That of "King Harry" is apparently transferred to the goldfinch from Henry the Eighth.

The distribution of our European goldfinch extends eastward to Southern Asia, where it exists, to some extent, side by side with *Carduelis* *orientalis* of Pallas, who erroneously, as it would now appear, considered *orientalis* only a variety of *Carduelis elegans*.

Canon Tristram found our own goldfinch sharing with the greater titmouse the shelter of cypresses, on the outskirts of Jerusalem. It is plentiful in Algeria. In Madeira it is still used as a "draw-water,' on the testimony of a recent writer to the *Field* newspaper. In Spain and Italy it is plentiful, as in Greece and the Ægean generally, particularly during the winter months. Chiddington, our Oxford bird-catcher, assures me that when quartered with his regiment in Corfu, he used to catch a great many goldfinches, though there was very little demand for them. In France and Germany it appears to be abundant; it was certainly one of the very few species that I could discover at Fontainebleau, in 1873. In Denmark it is local. In Norway I searched for it unsuccessfully, but have since seen a specimen from Christiansand. As to Ireland, the goldfinch is certainly common in some districts, because Irish goldfinches are supplied to Scotch and English markets. In Scotland it has much decreased of late years; partly from hard winters, in which the goldfinches, failing to migrate, perished of starvation, as suggested by Dr. Gray ("Birds of the West of Scotland"); partly because Glasgow and other town birdfanciers travel considerable distances to catch a few goldies, even for their own use; partly, as a shrewd Dumfriesshire shepherd points out to me very strongly, owing to the decrease of those "idle weeds," the seeds of which form the subsistence of the goldfinch, before the steady progress of agriculture.

The stronghold of the British goldfinch appears to me to be in Wales, where a friend has seen them as plentiful as sparrows, and whence an important portion of the goldfinches of Metropolitan dealers are procured. Bolton, in his "Harmonia Ruralis," remarks on the existence of a Welsh race of goldfinch, termed "Nicols." For my own part, I have nowhere seen the goldfinch so abundant as on the north coast of Devon and Somerset, between Minehead and Bideford; in this part of the country the goldfinch, as also the cirl bunting, may often be observed perching on telegraph wires. In South Devon, I have found the goldfinch fairly well represented, as also in Oxfordshire, Kent, Surrey, Essex, Herts, Hants, and Berks. It probably breeds in all our counties, except perhaps the counties nearest the Border. Mr. Parsons, of Carlisle, tells me that it is decidedly rare in his neighbourhood, and similar testimony as to the Lake district is borne by an excellent field naturalist.

Everywhere the abundance of goldfinches is primarily correlative to the abundance of food, though hawks and birdcatchers subsequently may destroy the balance. If only the goldfinch had the hungry appetite of *Passer domesticus*, which eats a cabbage white, or a beautiful demoiselle dragon fly without compunction, it would, no doubt, be able to hold its own much more satisfactorily.

But we must pass on from distribution to courtship.—I have already alluded to this in reference to the popular synonym of Proud Tailor. The performance in question, when the male finch sways himself rapidly from side to side with his dazzling golden wings slightly expanded, is considered by Dr. Darwin a valuable piece of evidence as bearing on natural selection.—(Cf. Darwin, "Descent of Man," Vol. II.)

I must confess that the motion in question has always appeared to my mind to be simply due to sexual excitement, though it may serve to rouse the love of the female. Song is perhaps as important a factor as colour. A female goldfinch, introduced to a couple of males this summer, paired in a few days with the smallest and most ill-favoured; the other goldfinch was not indeed in full song, but was a magnificent fellow in colour and size, and, moreover, was unencumbered; whereas his shameless little rival deserted a hen bullfinch (which he had fed steadily for several months), that he might woo the new-comer of his own race. The bond of affection, thus severed, had been joined by the two birds being confined together for several months. A female siskin, which died in April last, had paired with another goldfinch, which fed her also regularly.

The inter-breeding of goldfinch and bullfinch, or greenfinch, or linnet and bullfinch is now well-known to be possible in confinement. A fine hybrid between the two first was reared in 1880 by Mr. Thomas Lester, of Clifton Hampden, where I have repeatedly seen it, as well as its parents.

To Macgillivray's two cases of the male greenfinch pairing with the female goldfinch in a state of freedom, may be added that of a hybrid taken from a nest of goldfinches, in close proximity to that of a greenfinch, by Travis, the obliging keeper of the Western Aviary, Regent's Park.

A hybrid between a goldfinch and greenfinch, formerly in my possession, was bred, I have reason to believe, in the canary-room of a fancier in the South of England. He combined the most pugnacious of temperaments with great beauty of plumage; the greenfinch tints predominated.

Goldfinches ordinarily breed in orchards, though evergreens and even high quick hedges, as well as elms and oaks, are in turn selected. Richard Jefferies has described generation after generation succeeding to the same "bushy-headed codlings," with his usual felicity.—Cf. "Wild Life in a Southern Country," page 176.

The development of the colour sense in the goldfinch was well described by a writer in "Nature" of May 31st, 1877, who watched a pair of goldfinches, from an upper window, building on the extremity of a sycamore tree. To match the tree, the finches took its own blossoms, to match the sky overhead they chose forget-me-nots. As a result, though the flowers of course faded, the tints of tree and nest were so well matched, that from below nothing of the nest was visible beyond a slight apparent thickening of the leaves. This term, a pair of goldfinches built in some furze in a tiny Oxford bird-room, but the eggs, after fourteen days' incubation, were still unhatched. They are small, and bluish white, spotted towards the larger end with purplish red of two shades.

Though Bolton, F. O. Morris, and other writers have long since stated that the young broods of goldfinches were fed on insects, I have now for the first time found the testimony of two eye witnesses to the fact. Mr. Darbey, our sagacious Oxford taxidermist, tells me that the young broods of goldfinches, which he has repeatedly reared in a cage, by allowing the old birds to feed their progeny through the cage wires, have always been fed at first on small green flies, then on flies and thistle seed, and finally on seed alone. Chiddington opened the crop of a young one and bears exactly corroborative evidence.

Although the goldfinch is a late bird to go to nest, in England at any rate (for I have seen continental finches six weeks old on the 14th of June), I incline to think that a good many second broods are hatched. A Keble friend of mine, some four autumns since, found a nest of unfledged goldfinches towards the latter end of September!

The young, as soon as they leave the nest, may often be heard on the outskirts of their orchard haunts, recording in low, uncertain twitterings, the notes of their progenitors. So much is song due to imitation, that I not long since heard two brother hybrids, between the siskin and canary, singing most carefully the perfect song of the goldfinch tutor, under which they had been hung for instruction.

At least forty years have elapsed since Mr. A. E. Knox, then the chief authority on the birds of Sussex, pointed out in his ornithological rambles, how steadily the greater number of goldfinches, at any rate those that breed in our southern counties, would appear to draw from west to east, prior to crossing the English Channel at the narrowest strait of water. As yet I have had no opportunity of observing this point myself. It is sufficiently obvious that by far the larger number of the goldfinches that breed in Oxfordshire do leave the country before winter. I do not mean to imply that all goldfinches do so. On the contrary, there is no dearth of evidence as to the capture of a few goldfinches in winter; a dead goldfinch was found in the Parks after the great snowstorm of 1880. But the evidence of George Swayland, the well-known Brighton naturalist, is worth quoting. On page 102, of the Report of the Wild Birds' Protection Committee of 1873, he says: "After the nesting is over, the goldfinches go into the fields and feed on thistle and buttonweed; and about the commencement of October they come to the sea coast, ready to go away. They pass over Brighton and go as far eastward as Dover; they keep along the coast. When they return in spring, they come right across the water; they come from the south, but I never saw a bird go from Brighton across; I never saw it attempted in fact. When they return in April, they all come to the south and fly to the north, for I hear them coming over my head."

The young goldfinch is eight or ten weeks old when the first red feathers appear about the beak. Mr. Smith, the Charlbury bird-catcher, tells me that he once netted a goldfinch in Worcestershire, which combined the crimson flourish with the grey pole of the nestling. In this garb *Carduelis elegans* would appear to be returning to a primitive type, *i.e.*, to that of the ancestor which it perhaps shares with *orientalis*. In *orientalis*, the white and black of our goldfinch's head are replaced by ashen grey. The Himalayan goldfinch, common at Simla and elsewhere, is considerably smaller than *orientalis*, and possesses a brighter and more vivid scarlet face. But it does not appear to be absolutely certain whether *orientalis* and *carriceps* are distinct. I must reserve my own opinion until I have consulted a sufficient series of skins.

The crimson face of our normally plumaged adult goldfinch, probably appears in the females before the males. The assumption of this colour in confinement is a matter of "pain and grief" to many finches. The comparative absence of sunlight within houses may affect the tint of the "flourish." It is brighter in caged goldfinches, moulted out in the open-air, than in caged goldfinches moulted in-doors. In wild or caged goldfinches the crimson is brightest during the breeding season. Mr. Darbey is inclined to think that the goldfinch, like the bullfinch and kingfisher, loses some brilliancy or gloss of plumage after death.

The chief external sexual differences are the small size and dull tints of the female, her smaller and less pointed bill, the greyness both of her muzzle and of her "shoulders." The latter may be judiciously coated with sufficient blacking to deceive the unwary, so that it is well to rub it carefully! The crimson flourish, as a rule, terminates in the female before passing behind the eye, whereas it always passes well behind the eye in the male. So much difference exists, even among males, in size and colour, that goldfinches have often been divided into "woodland" and "garden finches," "elm tree," "pear tree," and "cherry" finches, according to the trees they respectively breed in. The strongest contrast in size I have seen was between an Irish goldfinch, no bigger than a siskin, and one of the large, very white-faced German goldfinches. As I remarked the other day, these German finches often lack the silvery tipping to the secondaries, equally well marked in immature and mature south coast goldfinches of the migratory race. Of the five classes of abnormal plumage, which I think that Mr. Blake Knox has described in the "Zoologist," I have not seen or even heard of the "cinnamon," though the linnet often exhibits a cinnamon phase. But before we discuss the more usual abnormalities, I wish to point out to you that the colour of the beak of the goldfinch varies seasonably. This specimen which I hold in my hand, was probably killed in autumn or winter, because the beak, as you see, is deeply tinged with black. As summer advances, the dark colour gradually disappears, until by the middle of the breeding season it has become as "clean as a whistle," *i.e.*, of an entirely pink colour. Similar changes are exhibited by many birds. Thus species so divergent as the hawfinch and the snow bunting exhibit, in summer, bills of decidedly dark blue, whereas in winter they have grey and yellow bills respectively. In confinement the legs of goldfinches become of a flesh-coloured tint, in lieu of the dark grey of the wild "black-legged" finch.

As to abnormities, if we put aside a "blue" goldfinch netted at Shoreham a few years back as identical with an escaped indigo finch, there remains for discussion yellow, crimson, black, and white phases of irregular coloration.

The only yellow variety that I have seen was netted by Bryans, the Hinksey birdcatcher, in 1877. Though a bird of the year, its under parts were decidedly tinged with yellow. After keeping it for some time, I gave it to a friend in Herts, in whose possession it unluckily died next year.

Of crimson varieties, the most distinct is that of a band of crimson crossing the nape of the neck in the white crescent that bands the black. The first of this variety shown to me was a large house-moulted German; another, sold to me in Oxford by a hawker, possessed the same character, and enjoyed the fly of my rooms in college daily, until the carelessness of a scout drove him in fright through an open door. Of black goldfinches, several stuffed examples are to be seen in the Edinburgh Museum. One, pure black, was netted by Landsprey, near Oxford, about 1860. Mr. Etable, the dealer in gold-crested reguli, &c., of Mortimer Street, Oxford Street, tells me that he lately possessed another entirely black goldfinch, reared from the nest as such. The last melanoid I have seen had an entirely black head, with the exception of a few crimson feathers, but not apparently from a diet of *hemp*, so productive of melanism in the bullfinch. Last and more important than the foregoing varieties, are those of albinism. The scarcity of pure albinos in the goldfinch, as compared with the linnet, &c., is partly due to the dislike of goldfinches for abnormally coloured mates, as exemplified by their preference for brown or green canary mates in confinement, to those of a pure light colour. A Garsington birdcatcher netted the only pied greypate or nestling goldfinch that I have as yet heard of. During last summer, two goldfinches were offered to me for sale with white heads. One was an imported German. But the form of albinism on which I wish especially to say a few words, is that of the "cheverel," "chivel," "cheviot," or "chibald" finch, the names of which are derived, either from the supposed stronghold of the variety in the Cheviot Hills, or from the A. S. "chefle" to chatter, adopted by Professors Newton and Skeate. The white in the crimson flourish, beneath the lower mandible, varies in size from the mere "speck" of the pea-throated or bastard "chevil," to the broad white throat, "cleancut," figured in Rowley's "Ornithological Miscellanies." The addition of a clear white chest and white cervical ring is necessary to the perfection of a "hobby cheverel." It is hardly necessary to point out that the merits of this variety, as regards mule breeding, are not superior to those of the common finch, any more than the "three by sixes"; in which six, instead of four, of th lateral tail feathers are stamped with white.

I want, in concluding this first paper on the goldfinch, to point out in a few words the value of the goldfinch to three classes of society.

To the farmer, the value of the goldfinch lies in its feeding for nearly the whole of its residence in England on the seeds of thistles, knapweed, dandelion, the males also on teazles, &c. At the same time, the goldfinch commits no kind of injury, to outbalance the good thus done.

To the commercial public, the goldfinch stands in the light of one of the most important birds of British trade. I do not wish to give you positive data on this point to-day. I would rather wait until my statistics are complete. But whether or not London birdcatchers have numerically increased, since Meyrick estimated their numbers, a quarter of a century since, at about two hundred, the fact remains that besides the birdcatchers, the "middlemen," to whom they sell their goldfinches, and the dealers who buy them for a third time in Scotland and the provinces, do each in turn add considerably to their incomes by their traffic in goldfinches.

Goldfinches are taken by bird lime, by trapcages, and spring traps, but especially by clap nets made on the same principle, so Wilkinson tells us, as those used by the ancient Egyptian fowlers, who salted and dried some small birds, as well as large ones, for food.

The social value of the goldfinch, as a pet that will live for ten or fifteen years in full health with care, is too obvious for me to dwell upon. I wish only to point out to those who sentimentally decry the caging of birds, that Skelton's poem on the death of Philip Sparrow, —than which imaginary bird

"Was never bird in cage
More gentil of corage
In doing his homage
Unto his Soueraine"—

shows, with all possible clearness, how fond Englishmen were of small cage birds, even before the Reformation. But if it be argued that our progress in civilisation should have thrown bird-keeping into disuse, we have only to point to two of the first scientific minds of the present century, to find grounds for a passionate love of domesticated birds.

Thus Mrs. Mary Somerville, in her ninetieth year, wrote: "We are fond of birds and have several, all very tame. Our tame nightingales sing very beautifully, but, strange to say, not at night. We have also some solitary sparrows, which are, in fact, a variety of the thrush *(Turdus cyaneus)*, and some birds which we rescued from destruction in spring, when caught and ill-used by the boys in the streets; besides we have our dogs; all of which afford me amusment and interest."—"Memoirs of Mary Somerville," p. 357.

The delight which George Stephenson took in birds is so well known, that I need only refer members to Smiles' "Lives of the Engineers" for details of his pets, particularly of that blackbird which, bred in the woods, yet slept on his master's bedpost every night.

But I have already kept you too long, and must sum up my paper rapidly.

In Art, the goldfinch is a great favourite. We all know it in the Madonna del Cardelino. It occurs in the publication of the Arundel Society, as fed by St. Francis, with a troop of other birds. It is excellently painted, with the sparrow-hawk, on a Horæ of the School of Van Eyck, circa 1410, in the Bodleian. It is magnificently depicted in Gould's birds; it is represented less gaudily, but with greater likeness in Messrs. Sharpe and Dresser's "Birds of Europe." The Eastern form, *carriceps*, to the best of my recollection, is included in Gould's first great work, "The Century of Himalayan Birds."

As to its position in Literature, the goldfinch is probably meant by Chaucer as the "finch;" as also by Shakspere in Bottom's ditty—

"The finch, the sparrow, and the lark,
The plain-song cuckoo gray."

Midsummer Night's Dream, III., 1, 133.

Again, the expression—

"Finch egg,"

is used by Thersites to Patroclus as a slight thing, easily crushed, in *Troilus and Cressida*, Act V., Scene 1, 4.

The goldfinch heads the list of birds, summoned—

"Some to sing and some to say,
Some to weep, and some to praye',
For Philip Sparowes soule."

In Dryden's "Flower and the Leaf"; in Gay's "Wednesday or the Dumps"; in the writings of Cowper, Hurdis, Burns, in Dickens, among prose authors, we have ample references to the goldfinch, though such might be almost indefinitely multiplied. But to my mind, no lines recall the wild woodlands, on the edge of which goldfinches love to flutter round the prickly teazles, half so clearly as those simple words of Keats, in his poem to Leigh Hunt—

"Sometimes goldfinches one by one will drop
From low hung branches, little space they stop;
But sip and twitter, and their feathers sleek;
Then off at once, as in a wanton freak;
Or perhaps, to show their black and golden wings,
Pausing upon their yellow flutterings."

FRESH-WATER AQUARIA.

BY R. M. LLOYD.

As much pleasure and endless subjects for profitable study are derivable from a well-managed fresh-water aquarium, I offer a few hints on the subject, based on a somewhat successful experience of several years, and trust they may be of assistance to some of my fellow-naturalists.

The main point to be kept in mind, and on attention to which success chiefly depends, is the imitation of nature—that is, the subjects placed in an aquarium must, as far as possible, be surrounded by conditions which form a near approach to those in which they naturally grow and thrive.

Excluding the inhabitants of the sea, all the many and varied kinds of aquatic life may be roughly divided into those which live in ponds, or comparatively slow running streams, and those which live in rapid ones. This division will serve to indicate the reason why some animals cannot be kept in an aquarium, for, generally speaking, it is only those included in the latter group which do not thrive in an ordinary well-managed tank.

I have been many times asked the question: How often do you change the water?—and usually meet with expressions of astonishment when I answer that it is unnecessary to do so at all. Yet, if the inhabitants of the tank are in health this is quite correct, though it is well, as we shall presently see, to have an occasional "clean out."

There should be a proper proportion of animal and vegetable life in an aquarium, or rather a preponderance of vegetable life; for, although such animals as are carnivorous, and at the same time air-breathing, do not directly require it, yet, as they feed on those who are or have been either vegetarians or water-breathers, or both, indirectly they do, as besides forming food-stuff, plants are necessary to render the water capable of oxidising the blood of such of its inhabitants as do not derive their supply of oxygen directly from the air.

Water absorbs oxygen from the atmosphere by the simple contact of their surfaces, and if the superficial extent brought into contact is very greatly increased, as by the formation of waves, the flowing of a stream, and more especially by violent agitation, such as is caused by the beating of waves on the shore, enough oxygen will be absorbed to supply the animal inhabitants with all they require. As this cannot take place in pools or other small pieces of water, the supply must, consequently, be obtained in some other way. The action of the chlorophyll or the green colouring matter of plants on the carbonic acid gas contained in the water is the most constant method. It decomposes it into its two elements, carbon and oxygen; appropriates the former to its own use, and liberates the latter for that of animals.

Hence it will be seen that, although some animals may be kept in an aquarium without plants living with them, it can only be by the aid of extraneous assistance; food must be placed within their reach; and the water must be aërated by agitation or some other mechanical means.

The first requirement is a vessel to contain the water. This may be made of almost any material, but the sides should either be vertical or inclined from the bottom outwards. "Fish globes," with the water-line above the greatest horizontal diameter are to be shunned as the very worst form. A slate tank with plate glass front is by some considered the best vessel for an aquarium. I am, however, inclined to think that the use of rough plate glass for the sides and back would be an advantage, but an ordinary glass pan of about sixteen inches diameter and six inches deep will do exceedingly well; such vessels are sold under the name of "pastry pans," I believe, and cost about half-a-crown each. Ordinary propagating glasses inverted and held in position by a base turned out of a block of wood make very good tanks; small hand glasses, of about four inches diameter, placed on the top of hyacinth vases are also very useful, and are not unornamental. Pickle bottles, earthenware pans, and other such like ordinary vessels may frequently be used as auxiliaries with advantage.

The best water to use is generally that in which the animals have been found thriving, but such as is ordinarily supplied by water-works is admirable for aquarium purposes, being in many cases filtered stream water. Rain water will do for many things, but pump water is to be altogether avoided.

The bottom of the tank should be covered with about an inch of grit and fine gravel, on which it is well to place some pieces of rock or rough stone. It is better to avoid limestone in any form, and use slaty or siliceous stones only. Resting and hiding places are thus formed for the animals, and plants are better preserved from being uprooted.

I consider the American weed (*Anacharis Alsinastrum*) the best for aquaria, as none thrives so well or affords better food. It, moreover, furnishes a good example under the microscope of the circulation of cell contents, and the quantity of oxygen given off by it when freely exposed to the sun's rays is very great, the bubbles of gas ascending from it in continuous streams. The Anacharis also requires no care in removing and planting; any scraps thrown into the tank will soon send down rootlets from the joints and anchor themselves among the gravel; and even if any of the larger burrowing mollusks are kept in the tank, the plants, though being constantly uprooted, will still continue to grow. Microscopic treasures are frequently to be met with on it in abundance, but perhaps not so many in number as on the Water Millfoil, (*Myriophyllum*,) which is another very good plant for an aquarium. Chara and Nitella are also good. *Vallisneria spiralis* is very pretty and interesting, but it requires a rather deep tank, and its roots must be kept properly embedded among the stones at the bottom. I have kept Nitella for two years without it having at any time had its roots embedded

I have always found my aquaria do best when placed before a window where they may have the direct rays of the sun for a good part of the day; the plants are thereby induced to grow vigorously, and these and the pieces of rock afford ample shade for those animals that require it. However, if it is not convenient to have it in such a position any other will do, provided a fair amount of light can get to it. There may be nevertheless a disadvantage in an excess of direct sunlight. It causes the glass sides of the vessel to become covered with confervoid growth, which although useful both as food stuff and for the evolution of oxygen, considerably obstruct the view through the glass, a desideratum, especially if a tank microscope is one of the possessions of the proprietor of the aquarium.

Water should be added from time to time to replace what has been lost by evaporation and other causes, so as to keep the level about constant. Dead animals should be removed, but decaying water plants, though somewhat unsightly, are such excellent harbour and food for microscopic creatures that they should rather be introduced than removed.

Occasionally, say once a year, in the late autumn or early spring, it is well to have a thorough clean out. At these times all the live stock which it is wished to preserve must be taken out, as also the pieces of rock and plants, and so much of the water as can be taken out in a clear state, drawn off with a syphon or otherwise carefully removed into another vessel, so that it may be returned to the tank together with the animals, plants, and stones after the cleaning process has been gone through. The reason for this is that there will probably be many germs in it, besides entomostraca, rotifers, and other small organisms which it is desirable to retain. The whole of the gravel and grit must be taken out and thoroughly washed. An enormous quantity of dirt will be found mixed up with the stones. This is chiefly the effete matter which, falling to be bottom, is hidden among them—indeed, this is one of the uses they subserve. If there are any snail eggs, vorticella, or other treasures attached to the glass, they should be carefully stripped off, and although they cannot be replaced in their original positions, they will, if returned to their renovated home, continue to develop or form new colonies, as the case may be. The glass, if there is any confervæ on it, should be well scrubbed with soap and warm water, taking care that all the sand and grit is removed, otherwise there will be most likely a number of undesirable scratches to be seen upon it.

In such an aquarium as has been described, almost any creature that inhabits fresh-water can be kept in health with little trouble, provided over-crowding does not take place; but due care must be exercised in the selection of its inhabitants. For instance, it will not be wise to place fish in it, if it is wished to preserve minute forms of life, these being their natural food. There should generally be a fair number of snails present, as they greatly assist in keeping the vegetation within reasonable bounds, and being particularly fond of confervæ and very ravenous, the glass is usually kept fairly free from it, which, as we have seen, is desirable. The best species are *Lymnæa stagnalis*, *Paludina vivipara*, *P. contecta*, and any of the larger species of Planorbis; *Planorbis corneus* being the largest, is to be preferred, but *P. carinatus*, *P. spirorbis*, as also *Lymnæa peregra* and *Bythinia tentaculata* are by no means unsightly, and are only inferior in point of size to the others above mentioned. Snails are exceedingly interesting objects in the very young state under the microscope, and the process of development in the egg can be better studied in those of the fresh-water mollusca than perhaps in any other. *Bythinia tentaculata* is the one of all others with which I am acquainted that arranges its eggs in the most convenient form for observation. They are placed in rows of two or three abreast and never on the top of one another. They are, moreover, of a comparatively large size, and their envelopes are very pellucid. The young of the Lymnæa, as also the full-grown Physæ, are very interesting to watch as they ascend and descend through the water by means of a mucus thread which they secrete, but which, ordinarily invisible, can be shown to be present by passing a solid body such as a glass rod between the animal and the point of attachment of the thread. The large bivalves, Unio and Anodonta, may be introduced into the aquarium, and they assist in keeping the water clear, but they draw into their systems through their fringed syphon tubes diatoms, desmids, rotifers, and other small swimming and floating organisms. If they are in a tank they should be watched and removed as soon as death occurs, which may be known by the gaping of the valves of the shell, since such a large mass of decomposing animal matter kills some of the other inhabitants very quickly, besides giving off a by no means agreeable smell. They will, however, under ordinary circumstances, live several years in confinement.

Polyzoa are generally not difficult to keep in an ordinary aquarium in moderate quantity. The statoblasts or "winter eggs" should be allowed to remain in the water, for though some of them float on the top of the water, or cling to the sides of the tank, giving it a somewhat untidy appearance if they are in considerable numbers, yet the beauty they display when they burst, and the young individuals come forth, amply atones for the former slight unsightliness. The statoblasts may, however, if desired, be removed, and placed in an auxiliary tank to be kept through the winter. Indeed, it is a very good plan to keep specially interesting microscopic beings in separate small glass vessels, as they are the more conveniently got at when required for examination, and can also the better be preserved from their natural enemies.*

Fish, as has been mentioned, are usually not very desirable tenants, as they will not join the union and become members of a "happy family." The species best suited for confinement are the Roach and Prussian Carp. These may be transferred from their native waters direct, but the Perch, Pike, and Minnow, which also do well, should first be placed in a vessel where the water is changed, but at gradually increasing intervals, and in about a week or ten days they may be placed in their future permanent home. Gold and Silver Fish, as is well known, thrive well in a small tank, so does the common Stickleback, or Jack Bannel. This latter is one of the most interesting fish we have, as it builds a nest for its young, and in the spring-time the male is very gorgeous in his rainbow hues. The spawn and fry of fish can be kept, and are well worthy of examination with the microscope, being especially instructive as examples of embryonic development of vertebrates. It must be borne in mind that many creatures feed on the fry, their own parents included. Beetles may be placed

* Mr. Potts has introduced an admirable form for this and other purposes. It is in shape a large Zoophyte trough about 4in. in height and width. It has an extended base, so that it will stand in a window, and the depth from front to back being 1in., a pocket lens can conveniently be brought to bear upon anything in it. They are to be had at Miss Bailey's, in Bennett's Hill, Birmingham.

in an aquarium in almost any numbers, but they will soon be reduced to a very small one, as they are exceedingly voracious, pugnacious, and regular cannibals.

Many other animals besides the few indicated may be kept in an aquarium, but overcrowding will cause great mortality. If convenient, it is well to have several large tanks, so that those animals which will not keep the peace with their fellow-lodgers may be separated. It is also a good plan where objects for the microscope are specially wished to be always at hand, to have one tank very stagnant, *i.e.*, where the conferva is encouraged to grow vigorously and never cleaned out; but if the hints given above are followed, a great number of species may be kept and will flourish in a single tank.

THE FLORA OF WARWICKSHIRE.

AN ACCOUNT OF THE FLOWERING PLANTS AND FERNS OF THE COUNTY OF WARWICK.

BY JAMES E. BAGNALL.

(Continued from page 212.)

CARYOPHYLLACEÆ.

ARENARIA.

A. trinervis, *Linn.* *Three-nerved Sandwort.*
Native: In woods, on banks, waysides, &c. Common. May to July. Area general.

A. serpyllifolia, *Linn.* *Thyme-leaved Sandwort.*
Native: In fields, woods, on wall tops, banks, &c. Common. June to August.
Var. *a. sphærocarpa.* Common throughout the country.
Var. *b. leptoclados.* More rare, but having a wide range.
I. Sutton Park; Coleshill Heath; wall tops, Nether Whitacre; wall near Arley Wood; walls near Hartshill Stone Quarries; Hampton-in-Arden,
II. Corn fields, Tachbrook, *Y. and B.;* Honington, *Newb.*; Old City Walls, Coventry, *Kirk.*; Lias stone walls, Kineton.
[*Alsine tenuifolia,* Crantz. Very rare. Is recorded by Rev. A. Bloxam, from a gravel pit, Lower Hill Morton, *R.S.R.*, 1874; Hoo Hill, near Polesworth, *J. Power.*
I do not think this plant is more than a casual weed in Warwickshire.]

SAGINA.

S. apetala, *Linn.* *Small-flowered Pearlwort.*
Native: On walls and sandy places. Local. May to September.
I. Sutton Park, Castle Bromwich, Hampton-in-Arden, Middleton.
II. Harboro' Magna, *Rev. A. B.*; frequent on brick walls about Rugby, *R.S.R.*; Wootton, Kenilworth, *Y. and B.*; Honington, *Newb.;* Stratford-upon-Avon, Harbury.

S. ciliata, *Fries.* *Ciliated Pearlwort.*
Native: In sandy fields. Very rare. June, July.

I. Coleshill Heath, abundant in some seasons; sandy bank, north end of Sutton Park; very uncertain in its occurrence in both stations; in the Coleshill station absent whenever the crop is an annual one.

S. procumbens, *Linn.* *Procumbent Pearlwort.*
Native: On heathy sandy places, walls, and banks. Common. May to September. Area general.

S. nodosa, *Meyer.* *Knotted Pearlwort.*
Native: In marshy places. Rare. July to August.
I. Sutton Park! *Dr. Stokes, With.*, ed. 2, ii., 483, 1787; Sutton, *Freeman, Phyt.* i., 262; Coleshill Heath, *Bree., Purt.*, i., 223.

SPERGULA.

S. arvensis, *Linn.* *Corn Spurrey.*
Native: In cornfields, on heaths and waysides. Common. May to August.
The variety *a. sativa* is the most frequent form in sandy and gravelly soils.
Var. *b. vulgaris* is a not unfrequent plant in marly soils, the two plants are so closely allied that I have not separated them in my note book.

SPERGULARIA.

S. rubra, *Fenzl.* *Field Sand Spurrey.*
Native: On walls, heaths, waysides, and sandy fields. Locally common. June to September.
I. On heath lands, Sutton Park; waysides, Hampton-in-Arden; Maxtoke and Coleshill Heath; near Solihull; sandy fields, near Packington; wall tops, Hartshill and Nuneaton; waysides, Cornels End, near Berkswell.
II. Turnpike road to New Inn, Alcester Parish, *Purt.*, i., 215; between Milverton and Ashow, *Perry, Fl.*; cemetery walls, Rugby, *R. S. R.*; Milverton, Lye Green! *Y. and B.*

ILLECEBRACEÆ.

[*Herniaria hirsuta* has been found near the Tanyards, Kenilworth, but cannot be considered as more than a waif.]

SCLERANTHUS.

S. annuus, *Linn.* *Common Knawel.*
Native: In cultivated fields, and on heath lands. Locally common. June, July. More or less abundant throughout the whole area.
II. Var. *b, biennis.* Sandy pastures at Milverton. *H.B.*, *Exch. Club. Rep.* 1877-8.

MONTIA.

M. fontana, *Linn.* *Water Blinks.*
Native: In damp woods, borders of streams, marshes, &c. Local. April to August.
I. Sutton, *Freeman, Phyt.* i., 192. Sutton Park; Marston Green; Coleshill Pool; Cornels End; Stone Quarries, Hartshill; Shirley.
II. Hasler, *Purt.* i., *91.* Hill Wooton, *Perry Fl.* Lye Green! and Wroxall, *Y. and B.* Combe Woods.
Var. *b. rivularis,* is an elongated variety, occurring in ditches and streams. Rather more local than the type. Abundant in Sutton Park; Marston Green.
[*Claytonia perfoliata,* Don, was found by Dr. Baker in the Royal Hotel Grounds, Sutton, but was merely a garden casual.]

ELATINACEÆ.

ELATINE.

E. hydropiper, *Linn.* *Water Wort.*
Native: Forming small matted tufts under water. Very rare. August.
I. Coleshill Pool, *Herb. Perry, Dr. Lloyd.* 28, Warwickshire, Lloyd specimen. *Top. Bot.*
I have never seen the plant myself, although I have made special searches for it.

HYPERICACEÆ.

HYPERICUM.

H. Androsæmum, *Linn.* *Tutsan.*
Native: On hedge banks. Rare. July, August.
I. Lane from Knowle to Hampton-in-Arden; lane near Whey-porridge Lane, Solihull.
II. In woods, Meriden, *Purt.*, iii., 374; hedge banks, Honily; Kenilworth Chase; Burton Green, *H.B.*; near Berkswell, *H. Cox.*
Occurring in single individuals, often at long intervals, but always, so far as my own experience serves, remote from cultivation.

H. perforatum, *Linn.* *Dotted leaved St. John's Wort.*
Native: On hedge banks and bushy heaths. Common. July to September. Throughout the whole area.
Two forms occur, but are hardly distinguishable.

H. dubium, *Leers.* *Imperforate St. John's Wort.*
Native: In marshy places, and on damp heaths. Rather rare. July, August.
I. In Mr. Digby's wood, Meriden, *With.*, iii., 816; near Meriden! *Aylesford, B.G.*, 637; Packington, *Freeman, Phyt.*, i.; footway from Meriden main road to Cornel's End; Railway banks, near Aston Church, 1874; near Boultbie Wood, Meriden; Canal bank, near Solihull; Sutton Park; Walmley,* near Sutton.
II. Between Leek Wootton fields and Stoneleigh, *Perry, Fl.*, 64; Lower Hill Morton Road, *Rev. A. Blox.*; Hill Wootton, *Y. and B.*; Whitnash and Chesterton, *H.B.*; near Rugby, *R.S.R.*; Spernall Ash*; Alcester.*

H. tetrapterum, *Fries.* *Square Stemmed St. John's Wort.*
Native: In marshes and moist places. Locally common. July, August.
I. Sutton Park; Coleshill Pool; Bannersley Pool, &c.
II. Whitnash, *Y. and B.*; Honington; Tredington, *Newb.*, Alveston.

H. humifusum, *Linn.* *Trailing St. John's Wort.*
Native: In fields, and heathy and gravelly places. Rather common. July, August.
I. Sutton Park; Bodmire, near Sutton; Hartsbill; Barston Marsh, &c.
II. "Rare, Kings Coughton, Alcester Heath," *Purt.*, i., 354; opposite to Stoneleigh Lodge, *Perry*, 1817; at the Woodloes, near Warwick; on the Turnpike Road from Warwick to Leamington, *Perry, Fl.*, 64; Kenilworth, *Y. and B.*; rare, near Rugby, Lower Hill Morton Lane and Furze Lane, *R. S. R.*, 1877.

H. pulchrum, *Linn.* *Upright St. John's Wort.*
Native: In woods and on heaths and heathy footways. Locally common. June to August.

* The plants from these stations appear to be the typical form. Our most frequent form appears to be the variety *b. maculatum.*

I. On the east side of Edgbaston Park, *With*, iii., 819; Solihull district; Sutton Park; Marston Green; Middleton; Coleshill; Packington, &c.
II. Oversley! and Ragley Woods! *Purt*. i., 354; Bagington Park; Leek Wootton fields; between Warwick and Hatton, *Perry*, 1817; Lower Hill Morton and Dunchurch Road! *R. S. R.*; Alveston pastures, *Newb.*

H. hirsutum, *Linn.* *Hairy St. John's Wort.*
Native: In woods, copses, and waysides, in marly and calcareous soils. Locally common. July, August.
II. Near Stratford! Wootton Field; *Perry* 1817. Chesterton, *Y. and B.* Salford Priors! *Rev. J. C.* Chadshunt, *Bolton King.* Oversley Wood; Drayton Bushes; Yarningale Common; Bearley; Binton; Edge Hills; Rowington Canal Bank.

H. elodes, *Linn.* *Marsh St. John's Wort.*
Native: In bogs and marshes. Very rare. June, July.
I. Bogs on Birmingham Heath. *With.* iii., 818. Coleshill Pool! and Bog; *Purt.*, i., 355. Sutton and Coleshill. *Freeman Phyt.* i., *262.* This plant is most abundant at Coleshill Pool, but I have never seen it elsewhere in the county, and am convinced that it does not now occur in Sutton Park, even though it may have done so in 1841, when Freeman recorded the plant.
[*H. calycinum*, Linn. is recorded from Compton Verney, but has no claim to a place in the Flora.]

MALVACEÆ.

MALVA.

M. moschata, *Linn.* *Musk Mallow.*
Native: On hedge banks, in fields, &c. Locally common. June, August.
I. (*Malva Alcea*), in hedges, and at the side of fields; *Gough's Camd.* ii., 350, 1789. Edgbaston Lane; *Ick. Anal.*, 1837. Sutton Railway Bank; Lane from Cornell's End to Berkswell; Water Orton; Hampton-in-Arden; Coleshill; Knowle, &c.
II. King's Coughton and Coughton Court; *Purt* i., 324. Near Stoneleigh; Hatton! On the Stratford! and Kenilworth Roads to Warwick, *Perry Fl.* 59; Milverton, *Y. and B.*; rare in the Rugby district, near Hill Morton, *R. S. R.*; Honington Park! *Newb.*; Salford Priors; Brandon; Great Alne near Railway Station; near Henley-in-Arden, &c.

M. sylvestris, *Linn.* *Common Mallow.*
Native: On hedge banks, waste places, &c. Locally common. May or June to August.
I. Sutton; Knowle; Marston Green; Wishaw; Hampton-in-Arden, &c.
II. Kenilworth, &c., *Y. and B.*; Alderminster and Stratford! *Newb.*; Brandon; Ufton, &c.

M. rotundifolia, *Linn.* *Dwarf Mallow.*
Native: On roadsides and waste places. Rather local. June to August.
I. Sheldon, *Rev. J. Gorle*; Marston Green; Curdworth, &c.
II. Milverton Village, *H. B.*; Tredington, Honington, Blackwell, Shipston-on-Stour, *Newb.*; Stratford; Wilmcote, Alveston.
[*Malva nicæensis*, All., occurs as a casual on waste ground near Kenilworth, *H. B.*]
The seeds of this and other casuals are brought with foreign skins.

TILIACEÆ.

TILIA.

T. grandifolia, *Ehrh.* *Large leaved Lime.*
Denizen: Hedges. Rare.
II. "Warwick," *Comp.*, *Cyb.*, *Brit.*, 129; Mr. Kirk considered some trees of this species, near Coventry, as native; why, I am unable to state; I do not think it has any claim to be considered native in any Warwickshire station where I have seen it.
T. intermedia, *DC.* is most abundant in many of our hedges and parks, but is always a planted tree. Those at Baddesley Clinton, *Y. and B.*, are undoubtedly planted. Mr. Bromwich says it "appears wild at Burton Green and Kenilworth."

T. parvifolia, *Ehrh.* *Small leaved Lime Tree.*
Native: In woods and hedges. Rare. July.
I. Hartshill Hayes, two trees only observed.
II. Beausale Common, *H.B.;* Brandon, *Kirk;* Whitmore Park, *T. Kirk, Herb. Perry.*
It is impossible to decide what claim any of our forest trees have to be considered wild, as even in primitive woods, such as Chesterton Wood, saplings are constantly planted.

LINACEÆ.

RADIOLA.

R. millegrana, *Sm.* *All-seed Flax.*
Native: On moist heathy places. Rare. July, August.
I. Coleshill Pool, *Purt.* i.; *Freeman*, *Phyt.* i., 262; heathy footways, Balsall Common; near Honily! *H.B.*
II. Shrewley, *H.B.;* about a mile south of Rugby, side of Barby Road, *R.S.R.*

LINUM.

L. catharticum, *Linn.* *Purging Flax.*
Native: On banks and in fields. Common, more especially in marly soils. May to July. Area general.
[*L. angustifolium*, Huds., is recorded from the side of Hill Morton Road, near Rugby, *R.S.R.*, 1875; Burton Dasset, introduced with grass, *Bolton King;* merely a casual weed.]
[*L usitatissimum*, Linn. *Common flax.* Springs up occasionally in cultivated fields, and on railway banks. It was abundant on the new railway bank at Sutton Park, in 1868, but was not permanent. Purton records it from Broome, *Mid. Flor.*, i., 164; and Mr. Bromwich finds it near Kenilworth, Stoneleigh, Honily, and Leamington. I believe it is often introduced by bird catchers, being used as one of their baits.]

(To be continued.)

NOTES ON ROCKS,

FOUND IN THE NORTHERN DRIFT GRAVELS.

BY W. C. LUCY, F.G.S.

The following rocks derived from other localities, occur near to and within a few miles of Gloucester, generally at heights from 50 to 250 feet above sea level:—

Millstone Grit.
Felstone.
Syenite.
Granite.
Lickey Quartz.
Carboniferous Limestone.
Flint.
Chalk (rare.)

AND ON LIMBURY HILL,

(Eight miles from Gloucester,) Silurian Rocks, containing the following fossils:—

Heliolites	Wenlock Limestone.
Halysites catenularius	,, ,,
Cyathophyllum	,, ,,
Favosites alveolaris	,, ,,
Petraia bina	Caradoc.
Chonetes lata	Upper Ludlow.
Orthis elegantula	,, ,,
Atrypa reticularis	Wenlock Limestone.
Phacops caudatus	,, ,,
Rhynchonella Wilsoni	,, ,,

In the Northern Cotteswolds, at the following places, not far from Moreton-in-the-Marsh, are found:—

AT LITTLE WOOLFORD.

Millstone Grit.
Quartz.
Quartzose Pebbles.
Hard Chalk.
Red Chalk, (probably from Lincolnshire.)
Large angular Cretaceous Flints.
Granite.
Fine-grained Trap.
Mountain Limestone.
New Red Sandstone.

AT BERRINGTON (NEAR CAMPDEN.)

Millstone Grit.
Coal Measure Sandstone, with Stigmaria ficoides.

AT GOOSE HILL (527 FEET HIGH.)

Flints, Jasper, &c.

AT COMPTON SCORPION.

Fine-grained Greenstone, and
Mountain Limestone, with encrinital stems.

AT BLACKDOWN.

Millstone Grit.
Gneiss.
Fine Quartz.
Brownstone from the Old Red Sandstone.
Hornblende Greenstone.

NEAR TO BARTON-ON-THE-HEATH.

Large Flints.
Chalk.
Greenstone.
Millstone Grit.
White Quartz.
Permian.

NEAR FOURSHIRE STONE.

Coal Measure Sandstone, with Stigmaria ficoides.
Amygdaloidal Greenstone.
Chalcedony.
Agate.
Metamorphosed Slate.
Saccharoid Millstone Grit.

EBRINGTON HILL TO CAMPDEN, *via* LONGLANDS.

White Quartz and Jasper are abundant, with some Slate and Flint.

METEOROLOGY OF THE MIDLANDS.

THE WEATHER OF JULY AND AUGUST, 1881.

BY CLEMENT L. WRAGGE, F.R.G.S., F.M.S., ETC.

July (see table in last number, page 221) was dry, with a high average temperature, and is in singular contrast with July, 1879. The period of heat, from the 4th to the 18th—with the sudden, temporary depression of temperature on the 7th and 8th—forms a most striking feature; and the succeeding cold period, from the 19th to the 31st, contrasted with the previous extraordinarily high readings, is equally remarkable. The barometer oscillated considerably throughout; yet its range, in accordance with summer conditions, was not wide. The chief depressions crossed on the 6th, 26th, and 31st. The crest following the disturbance of the 26th brought a grass frost on the 28th, which did much damage to tender crops. At Marlborough the terrestrial radiation thermometer registered 28·0, and beans and young potatoes suffered severely. The solar radiation instrument, at Burton, registered 147° on the 18th. The hay harvest was well gathered, but the crops appear to have been light and thin. In the west of Scotland the great heat was not experienced; and the rainfall was excessive. The total fall on Ben Nevis amounted to 15·186in., and that at Fort William to 10·880in. The sea temperature at Scarborough was 65·9.

* * * * * * *

August contrasted greatly with July. The first week proved fine and warm, but the remainder of the month was characterised by extremely wet, cold, and inclement weather; rain falling incessantly. Eight well-marked barometric depressions crossed our islands, viz., on the 5th, 8th, 13th, 17th, 19th, 24th, 26th, and 29th, the deepest being that of the 26th. At Stroud the rainfall was nearly ten times more than in August, 1880; and at Orleton the mean temperature was nearly 2½° below the average, lower than that of any August since 1860. Duration of sunshine at Hodsock 117·9 hours. Mean sea temperature at Scarborough 55·0. The grain in places suffered severely, and from Shropshire the potato disease is reported as appearing at Bishop's Castle.

STATION.	OBSERVER.	RAINFALL. Total for M. In	Greatest fall in 24 hours. In.	Greatest fall in 24 hours. Date.	No. of rainy d.	TEMPERATURE. Greatest ht. Deg	Greatest ht. Date.	Greatest cd. Deg	Greatest cd. Date.
OUTPOST STATIONS.									
Ben Nevis (a)	C. L. Wragge, Esq., F.M.S.								
Fort William (a)	C. L. Wragge, Esq., F.M.S	6·41	1·20	25	18	64·9	5	35·9	29
Spital Cemetery, Carlisle	I. Cartmell, Esq.	5·68	1·16	26	22	75·2	6	37·8	2
Scarborough (a)	F. Shaw, Esq., F.M.S.	7·53	2·47	29	20	81·0	5	45·0	28
Blackpool (a)—North Shore	C. T. Ward, Esq., F.M.S.					69·5	5	45·4	31
South Shore		6·23	1·62	25	22	70·9	5	40·0	31
Llandudno (a)	J. Nicol, Esq., M.D., F.M.S.	4·92	·87	29	20	72·2	4	45·7	2
Lowestoft (a)	H. E. Miller, Esq., F.R.A.S.	3·87	1·34	29	18	75·7	4	41·5	28
Altarnun, Cornwall	Rev. J. Power, M.A.	6·87	1·00	9	25	79·0	6	42·0	28
Sidmouth (a)	W. F. Radford, Esq., M.D.	5·05	·80	22	19	69·8	3	44·1	28
St. Augustine's, Ramsgate (a)	Rev. T. E. Egan, O.S.B.	3·70	1·29	12	19	74·7	6	48·1	20
MIDLAND STATIONS.									
GLOUCESTERSHIRE.									
Stroud	S. J. Coley, Esq.	4·31	·72	13	15	77·0	6	40·0	28
Cheltenham (a)	R. Tyrer, Esq., B.A., F.M.S.	3·65	·49	12 & 21	20	80·4	5	37·2	28
WILTSHIRE.									
Marlborough (a)	Rev. T. A. Preston, F.M.S.								
SHROPSHIRE.									
Woolstaston	Rev. E. D. Carr	4·48	·81	16	22	82·5	1	43·0	30
Bishop's Castle	E. Griffiths, Esq.	5·09	1·20	16	21	81·0	5	39·0	2
More Rectory, Bishop's Castle	Rev. A. S. Male	4·48	·65	22	23	74·0	4	38·0	2 & 28
Dowles, near Bewdley	J. M. Downing, Esq.	3·40	·91	23	15	85·0	4	39·0	25
HEREFORDSHIRE.									
Stoke Bliss	Rev. G. Alexander	3·46	·48	22	17	78·0	5	43·0	12 & 27
WORCESTERSHIRE.									
Orleton, Tenbury	T. H. Davis, Esq., F.M.S.	3·88	·52	22	18	81·0	5	37·7	28
West Malvern	A. H. Hartland, Esq.	5·11	1·15	23	17	83·0	5	41·0	12
Evesham	T. J. Slatter, Esq., F.G.S.	4·66	·67	17	18	79·0	6	42·5	28
Pedmore	E. B. Marten, Esq.	4·65	1·24	23	19	81·0	4	41·0	27
Stourbridge	Mr. I. Jefferies	4·45	1·27	23	17	80·0	4	39·0	27
Dudley	Mr. C. Beale	4·50	1·28	23	19	75·0	5	42·0	27
STAFFORDSHIRE.									
Dennis, Stourbridge (a)	C. Webb, Esq.	4·56	1·34	23	17	81·5	5	40·0	27
Kinver	Rev. W. H. Bolton	4·52	1·58	23	18	74·0	4 & 5	40·0	27
Walsall	N. E. Best, Esq.	5·68	1·12	8	19	73·0	5	44·0	27
Lichfield	J. P. Roberts, Esq.	4·61	·98	23	18	84·0	6	42·0	28
Grammar School, Burton	C. U. Tripp, Esq., M.A.	4·45	·71	22	22	86·0	5	37·1	28 & 29
Weston-under-Lyziard	Hon. & Rev. J. Bridgeman	4·16	·68	8	24	80·0	5	40·0	28
Wrottesley	E. Simpson, Esq.	4·47	·67	8	17	81·3	5	44·3	2
Barlaston, (a)	W. Scott, Esq., F.M.S.								
Tean	Rev. G. T. Ryves, F.M.S.	5·95	·95	8	22	79·0	5	38·0	27
Heath House, near Cheadle (a)	J. C. Philips, Esq., J.P.	5·81	·88	23	21	78·0	5	41·3	31
Oakamoor (a)	Mr. E. E. Kettle	6·14	·88	8	22	78·9	5	33·9	28
Beacon Stoop, Weaver Hills (a)	Mr. James Hall	5·57	·91	8	22	74·4	5	39·0	28 & 31
Alstonfield	Rev. W. H. Purchas	6·48	1·55	8	19	83·0	5	34·5	28
WARWICKSHIRE.									
St. Mary's College, Oscott	J. MacElmail, Esq.	4·15	·83	22	13	82·3	6	42·1	28
Henley-in-Arden	T. H. G. Newton, Esq.	5·39	1·07	23	19	82·0	5	40·0	28 & 29
Park Hill, Kenilworth	T. G. Hawley, Esq.	5·16	1·16	23	17	80·0	5	41·7	28
Kenilworth (a)	F. Slade, Esq., F.M.S.	5·46	1·14	23	20	81·0	5	41·0	28
Coundon, Coventry	Lieut.-Col. R. Caldicott	5·61	1·24	23	19	82·0	5	44·0	27
DERBYSHIRE.									
Stony Middleton	Rev. U. Smith	4·98	·64	8		73·0	5	38·0	[illegible]
Spondon	J. T. Barber, Esq.	5·16	1·1[illegible]	23	20	78·0		37·0	
Linacre Reservoir	C. E. Jones, Esq.	5·36	1·20	8	16				
Duffield	W. Bland, Esq.	6·10	1·21	23	20				
NOTTINGHAMSHIRE.									
Mansfield (a)	W. Tyrer, Esq., F.M.S.	5·72	1·34	23	24	82·7	5	41·3	28
Hodsock Priory, Worksop (a)	H. Mellish, Esq., F.M.S.	5·09	1·35	23	21	82·1	5	40·7	2
Tuxford	J. N. Dufty, Esq., F.G.S.	5·51	1·46	23	17	75·0	5	40·0	27
LEICESTERSHIRE.									
Loughborough (a)	W. Berridge, Esq., F.M.S.	4·85	1·20	23	19	84·1	5	38·9	28
Syston	J. Hames, Esq.	5·[illegible]0	1·19	8	24	80·0	6	40·0	28
Town Museum, Leicester	J. C. Smith, Esq.	5·18	1·36	8	19	82·0	5	41·0	28
Ashby Magna	Rev. Canon Willes	4·81	·89	23	19	83·0	4	39·0	28
Kibworth	T. Macaulay, Esq.	4·80	·72	8	22	80·[illegible]	5	33·0	18
Waltham-le-Wold	E. Ball, Esq.	5·53	1·53	8	19	79·0	5	39·0	27
Dalby Hall	G. Jones, Esq.	4·74	1·13	8	22	83·0	5	38·0	28
Coston Rectory, Melton (a)	Rev. A. M. Rendell	4·73	1·39	8	22	81·0	5	38·8	28
NORTHAMPTONSHIRE.									
Towcester	J. Webb, Esq.	4·79	·64	8	21				
Castle Ashby	R. G. Scriven, Esq.	4·28	1·02	23	18	80·0	6	43·0	27
Kettering	J. Wallis, Esq.	4·35	·89	23	18	77·0	6	43·0	28
Althorp	C. S. Groom, Esq.	4·25	·70	8	18	80·0	5	36·0	27
OXFORDSHIRE.									
Ratcliffe Observatory, Oxford	The Staff	4·84	·53	24	21	80·2	6	41·5	28
RUTLAND.									
Northfields, Stamford	W. H. Hayes, Esq.	4·92	1·03	23	22	84·0	5	33·0	28
Uppingham (a)	Rev. G. H. Mullins, M.A.	5·07	1·51	23	20	80·2	5	41·1	28

(a) At these Stations Stevenson's Thermometer Screen is in use, and the values may be regarded as strictly intercomparable.

Fort William, July, 10·90, 1·89, 29th and 30th; 69·7, 14, 41·0, 27th.

Beacon Stoop, July, 1·45, ·50, 26th and 11th; 78·9, 5, 41·9, 21st.

For Rainfall Statistics and Temperature as above respectively.

Correspondence.

Conchology.—On the 26th of August I was at Bearley, in Warwickshire, and I took among other shells *Clausilia rugosa*, var. *tumida*, also *C. Rolphii.* I sent the shells to Mr. G. S. Tye, who replied—"The *C. Rolphii* is a very interesting find, and you ought to record it in the 'Midland Naturalist' as a new shell for Warwickshire."—W. H. Boland, 23, Paxton Road, Birmingham.

Convolvulus Sphinx.—On Thursday, August 23rd, I had a fine specimen of *Sphinx convolvuli* brought in by the yard boy, who had found it sitting upon an iron gate in the yard. Afterwards one of the men said he had seen it there some days but had forgotten to tell me. I record the capture thinking it may interest some of our readers. — S. Robin Hallam, 22, High Street, Burton-on-Trent, September 2nd, 1881.

Cuckoo, &c.—On the night of the 6th August last we had a Cuckoo singing in our garden about eleven o'clock at night. It continued singing for nearly ten minutes at short intervals, and was, I presume, a young bird. I saw two Siskins at Kingussie on August 10th. The Chiffchaff is again singing. He and the Robin are our only songsters at present.—H. G. Tomlinson, The Woodlands, Burton-on-Trent.

Flora of Derbyshire.—The Rev. W. Hunt Painter, of Bristol, who formerly resided at Derby, has for some time been engaged in preparing a flora of that county. In reply to a request made to him by the Editors of this Journal he has sent the following communication: "I take up my pen to tell you a little about my 'Notes on the Flora of Derbyshire,' now being published in the 'Journal of Botany.' In compiling these notes I have been greatly assisted by several good botanists, whose names have been given in connection with the several plants and habitats for which they are responsible; and who have furnished me with specimens of the plants which they have found. Thus no plant is recorded of which I have not seen a specimen. The county has been divided into four districts, following the great Geological Divisions. I. The Peak district, extending from Glossop on the north to Ashbourne on the south, from Chesterfield on the east to the borders of Staffordshire on the west. II. The Coal district, lying immediately to the east of the former, and extending from Sheffield to Duffield near Derby. III. The Permian, lying still further to the east of the above, and bordering upon Nottinghamshire. IV. The district lying to the south of all the above, and including the southern portion of the county. The first and last of the above mentioned districts have been well worked, the 2nd and 2rd have been, I believe, scarcely touched. So far I have recorded about 700 plants, but on consulting 'Topographical Botany,' by Mr. H. C. Watson, whose recent decease we all so much deplore, I find that there are about 120 more, respecting which I have not succeeded in obtaining any information. May I therefore appeal to the botanists of Derbyshire and the neighbouring counties for assistance in obtaining full and complete information respecting the flora of this interesting county? I shall be very glad to enter into correspondence with any who may be willing to unite with me in this work, and to furnish them with the necessary catalogues, etc."—W. Hunt Painter, Bristol.

Reports of Societies.

BIRMINGHAM NATURAL HISTORY AND MICROSCOPICAL SOCIETY.—August 30th.—General Meeting. Mr. Bagnall exhibited *Artemisia vulgaris*, var. *coarctata*, Forcel, a variety new to Britain, and also intermediate forms between that and the type. He also exhibited two Fungi, *Agaricus (Amanita) pantherinus*, and *Russula emetica*, from near Stratford-on-Avon. Mrs. Marshall exhibited the skin of a pelican. Mr. Wagstaff exhibited *Stephanoceros Eichhornii* and *Draparnaldia glomerata*. Mr. H. W. Jones exhibited three crabs from the Great Orme, *Hyas araneus*, *Parcellana platychiles*, and *Corystes cassivelaunus*. Mr. Bolton exhibited some marine organisms. Mr. W. B. Grove exhibited a number of Fungi from the neighbourhood, including *Arcyria punicea*, *Trichia chrysosperma*, and *Peziza virginea* from Sutton, *Agarcius citrinellus*, *Coprinus plicatilis*, and *Bolbitius titubans* from Witton, and *Hydnum niveum* from Bromsgrove.—September 6th.—General Meeting. Mr. Bolton exhibited living Foraminifera, *Triloculina trigonula*, from Brighton; also *Follicularia Boltoni* from Evesham. Mr. Levick exhibited *Melicerta annulata*, and *M. tyro*, from his garden pond. Mr. Wagstaff exhibited *Plumatella repens* and *Cristatella Mucedo*, from King's Norton. Mr. J. F. Goode exhibited *Nonionina Barleeana*, from sand dredged at Oban during the visit of the society, in July, 1881. This is a purely northern species of Foraminifera, the most southern place at which it has been recorded being Scarborough. Mr. Silvanus Wilkins exhibited a collection of Fungi, found in a wood near Hunter's Lodge, about three miles from Axminster, on the Charmouth Road. Amongst them was the interesting Latticed Stinkhorn, *Clathrus cancellatus*, the odour of which is as disgusting as its form and colour are beautiful. It is very rare, being found only in a few places in the South of England. There were also specimens of the bright-coloured but poisonous species, *Amanita muscaria* and *Boletus luridus*, and a large one of the edible *Boletus edulis*. Mr. Robinson exhibited *Polyporus sulphureus*. Mr. R. M. Lloyd exhibited *Polyporus squamosus*, from Hodge Hill, Castle Bromwich. Mr. W. B. Grove exhibited the following Fungi, *Agaricus sublateritius*, *A. rubescens*, *Paxillus involutus*, *Cantharellus aurantiacus*, *Russula Emetica*, *Boletus edulis*, *Polyporus sulphureus*, *Tremella foliacea*, *Peziza vesiculosa*, *P. cinerea*, *Bulgaria inquinans*, and *Nectria cinnabarina*, all from Sutton Park.—September 13th.—Biological Section. Dr. Deane exhibited *Amanita muscaria*. Mr. W. Southall exhibited the fruit of *Caryocar nuciferum*, (Butter-nut,) from South America. Mr. Bolton exhibited *Floscularia trifolium*, found by Mr. Wagstaff near Birmingham. This rotifer was discovered for the first time in Scotland last year. Mr. J. E. Bagnall exhibited *Agaricus pantherinus*, *A. rubescens*, *A. melleus*, *A. candicans*, *A. phyllophilus*, *A. laccatus*, *Lactarius zonarius*, *L. subdulcis*, *Marasmius urens*, *Cortinarius hinnuleus*, *Lycoperdon gemmatum*, and *L. pyriforme*. Mr. C. J. Watson exhibited a bottle of gas obtained from confervoid growth in a marine aquarium, and which was shown to consist chiefly of oxygen gas. Mr. S. Wilkins exhibited *Cuscuta europæa* (Greater Dodder) from near Axminster. Mr. W. P. Marshall exhibited a series of drawings from the Virgularia specimens of the Oban dredging, and pointed out their non-agreement with the statement made in Nicholson's Manual of Zoology that the polypes of Virgularia are of two distinct kinds on different portions of the stem—one kind sexually complete and furnished with tentacles, and the other kind sexless and without tentacles. Mr. Marshall suggested that this difference in the polypes is only due to their being at different stages of their development, and pointed out that the polypes in most of the Oban specimens showed a gradual progression from a rudimentary state at the bottom to a fully developed state at the top, while in other specimens they all showed a fully developed state throughout the entire length.—Sept. 20th.—Microscopical General Meeting. Mr. J. Levick exhibited *Cyathus vernicosus*, the bird's-nest fungus. Mr. T. Bolton exhibited *Limnocodium Sowerbei*, the fresh-water medusa, lately discovered in the tanks of the *Victoria regia*, at the Royal Botanical Gardens; also *Pedalion mira*, a strange and rare rotifer. Mr. Wright Wilson exhibited and made some remarks about a parasite on a fish caught in the River Cole. Mr. Badger exhibited, on behalf of Mr. Eliezer Edwards, *Stigmaria ficoides*, from the Welsh coal measures. Mr. W. J. Harrison exhibited Stalagmite from Gibraltar, and *Ammonites biplex*, showing the nacreous lustre of the shell. Mr. J. F. Goode exhibited a vertical section of a lower jaw of a mole, with the teeth *in situ*. Mr. Slatter exhibited *Ribes alpinum*, the alpine currant, from near Evesham. Mr. Marshall exhibited a series of sections of the stems of Virgularia and Funiculina, dredged at Oban. Mr. Bagnall exhibited a collection of Fungi, from Cut-throat Wood, Solihull, including *Hygrophorus coccineus*, *Russula cyanoxantha*, and *Nyctalis parasitica*. Mr. Grove exhibited a collection of Fungi from Sutton Park, including *Lepista nuda*, *Lepiota rhacodes*, *Hygrophorus psittacinus*, *H. miniatus*, and *Boletus luteus*.

BIRMINGHAM AND MIDLAND INSTITUTE SCIENTIFIC SOCIETY. September 7th.—The ninth annual meeting was held in the Council Room of the Institute, the president (Mr. Hipkiss) in the chair. The annual report stated that the society now numbered 159 members, showing an increase of 22. Seventeen papers had been read during the past session, with an average attendance of 37·7 members per paper. At the Society's seven excursions the average attendance was 21·2. The librarian reported that 960 vols. had been issued. The finances of the society showed a balance in hand. The report having been adopted, a vote of thanks was passed to the officers and committee for their past services, also to the Council of the Institute for granting the use of room for the society's meetings. Mr. C. B. Caswell, F.I.C., was elected president; Mr. W. R. Morris vice-president; Mr. G. H. Twigg and Mr. C. J. Woodward, B.Sc., trustees; Mr. C. R. Robinson, treasurer; Mr. W. J. Morley, librarian; and Mr. W. H. Cox, hon. secretary. The retiring president, Mr. R. Hipkiss, then delivered an address on the influence of science and scientific achievements upon the social and moral elevation of the people. Passing in hasty review the early career of James Watt, his perseverance, trials, and final success in the perfection of the steam engine, he claimed for Boulton and Murdoch a great share in the honour. He paid a warm tribute to Murdoch for the introduction of gas for illuminating purposes, and regretted that whilst Rowland Hill had been deservedly thought of in our post office a similar testimony had not been raised in our gas office to the inventor of that which had played so conspicuous and important a part in contributing to the comfort of our homes and workshops. He drew attention to the advantages and improved social position of the workman since the days of George Stephenson, comparing them with the toils and drudgery and limited pleasures of the past. Among our chief advantages were cheap railway fares and the short time occupied between leaving the duties of the domestic hearth and obtaining the benefits derived from fresh fields and pastures new, and from contemplating nature in its varied and most delightful forms. The address was listened to with great attention, and a hearty vote of thanks was given to Mr. Hipkiss.

BIRMINGHAM MICROSCOPISTS' AND NATURALISTS' UNION.—August 1st. An excursion to Cheltenham for Gloucester; fossils were found in plenty along the Cotswold range. Good botanical finds were plenteous, among which were Carline Thistle, Wild Marjoram, and Deadly Nightshade. Shells were abundant everywhere, the best find being *Achatina acicula*, perhaps the rarest shell in the Midlands.—August 7th. The specimens collected during the excursion were exhibited. Mr. Madison showed a number of shells, Cardium, Littorina, and Purpura from a raised beach near Llandudno.—August 15th. Mr. Insley exhibited specimens of Lignite and plant remains from miocene beds, Bovey Tracey. A paper on "Spontaneous Generation" was read by Mr. Hindmarsh.—August 22nd. A meeting devoted specially to Botany. Mr. J. W. Neville showed a specimen of common coltsfoot leaf infested with micro-fungus, (*Coleosporum*.) Mr. H. Insley, plants illustrating various natural orders. Mr. Blay, the complete number of British Plantains. Mr. Boland, larva of *Bombyx Pernii*. Mr. Darley, parasite of common Stickleback.—August 29th. Mr. Baxter exhibited a specimen of *Lophopus crystallinus*. Mr. Boland, pupa of *Bombyx Pernii*. Mr. J. W. Neville, common Water Spider in its nest, showing it filled with air. A paper was read by Mr. Wykes on the "Telescopic Aspect of the Moon." The paper was descriptive and illustrated.

ON COMMENCING THE STUDY OF FUNGI.*

BY DR. M. C. COOKE, M.A.

It is contrary to my wishes that I should come here for the first time with an apology in my mouth; but so the fates have decreed. If you are disappointed, I shall be none the less so, that I am incompetent to the duty laid upon me. Congratulating you on having commenced this year a most interesting study, I must warn you that it is not an easy one. If any of you would go further than you have gone to day, it must be by dint of work. There is no royal road to a knowledge of fungi. After a quarter of a century of too close application, as the sequel has proved, I am still but a learner. I am still fain to confess how much there is I do not know.

Out of more than 3,000 British fungi, perhaps near 4,000 there, are 1,000 or more which may be collected and studied without the microscope, by the aid only of a simple pocket lens. This group is perhaps the best known as Fungi. Some there are who know no other. They are the mushroom and toadstool kind, and those hard woody excrescences which are not uncommon on rotting trees. These are called by fungus hunters, *Hymenomycetes*, because the spore-bearing surface forms a distinct exposed part of the fungus, as for instance the gills of a mushroom or the tubes of a polypore.

I need not enter upon either the minute anatomy or the classification of these higher fungi, but simply call to your mind that the spores, or analogues of seed, which they all produce are borne on the tips of clavate basidia, or fruit-stalks, which are surmounted by two or four little spicules, each of which carries a spore. If we take a mushroom, or a fungus of the same genus, in our hands, and examine it, we shall observe that the cap or pileus has on its under surface a number of radiating plates or gills, the whole surface of which is covered with the basidia I have just spoken of, closely packed together, and bearing on the spicules at the tips the spores of the fungus.

These spores differ in colour in different species, and the species are grouped together according to the colour of their spores. The Agarics with white spores equal in number all the rest with coloured spores. In some they are roseate, in others brown, in others purple, in others black. In determining a fungus, *the first thing to ascertain is the colour of the spores.* To facilitate this it is better to cut off the stalk and place the fungus, gills downwards, on dull black paper, and allow it to remain all night. During this time the spores will be thrown down upon the paper, and their colour can be determined. If the operator is also a microscopist, he may examine some of these spores in a drop of water, and discover their form and size, as well as their colour.

* Presented to the Birmingham Natural History and Microscopical Society at the Fungus Foray, October 8th.

Having experimented thus far, the novice will learn the meaning of the five groups into which the large genus *Agaricus* is divided in the handbooks. These divisions correspond with the colour of the spores.

Let us return again to our type mushroom or toadstool, and look once more at its composition. Some of them will have, as the mushroom has not, a sheathing cup or membrane at the base of the stem, and portions of the same membrane adhering like warts to the cap. This will indicate the essential features of a sub-genus with a comparatively limited number of species. Others, deficient of this volva, will have a ring round the stem, others again will have no ring. Then the gills must also be observed. In some the end next the stem does not touch the stem, in others it joins the stem, and in others it not only joins, but is decurrent, or runs some distance down it. By observing closely all these minute details, and many more, such as the smoothness or roughness, or silkiness of the cap, whether dry or viscid, elevated or depressed, you will at length be able, by dint of patience and perseverance, to determine for yourselves with tolerable accuracy the name of any Agaric which comes into your hands. Remember that all the most apparently trivial and minute differences must be sought out and made note of.

The faculty of close and accurate observation is the great desideratum of the fungus hunter, as of all students of Natural History. Those who have learnt how to observe will make the most rapid strides in Mycology. The most important of all faculties is that of knowing how to see, and, to some extent also, how to taste and smell.

You will pardon me if I omit to dwell on the distinctions between the genus *Agaricus* and the other genera closely allied to it, which would occupy considerable time, and are best learnt in the field with the aid of a knowing friend, and a little experience.

Other large fungi you may have seen which have no gills on the under surface of their caps, but in place of them there are a number of pinholes, which are the openings of tubes, the sides of which are lined with the basidia. The fleshy sorts are called *Boletus*, the harder woody kinds are *Polyporus*. If you cut one of them longitudinally through the stem, if it has one, you will see and learn better than by verbal explanation the difference between them.

Take up yet another fungus, and in place of either gills or pores, you will find teeth or spines, with the spore-bearing surface investing them on the outside. Thus, through all the various orders and genera of the higher fungi, you will find special modifications of structure, which are set forth in the written characters of the orders and genera under which all the species you may meet with will find their allotted place, and your progress will be very much indicated by the facility with which you may place every new comer into its own especial pigeon-hole.

I may naturally expect you to ask me, having found, and, perhaps, named a number of Agarics, what you are to do with such putrescent plants, in order to have some record of your labour. I *cannot* recommend you to waste your time in attempting to cut them in slices and dry them, since, when you have done so, they will give little or no idea of the living plant. There is only one alternative—*you must learn to draw and colour them to the life.*

This is not such a fearful task as it may seem, and, with a little experience, one who has had no practice in drawing will be able to do it very well. Permit me a hint or two to those who persist in affirming that they cannot draw. Take your Agaric, with a sharp knife cut it right through the cap and down the stem into two equal halves. Lay the cut surfaces a minute or two upon blotting paper to absorb moisture. Then take one-half and lay it, cut surface downwards, on paper for drawing. Hold it there, or pin it there, so that it shifts not. Then with a sharp pencil mark round the cap, gills, and stem, tracing the form accurately on the paper. Remove the half fungus, and complete the drawing by hand along the upper edge of the gills, so as to present a correct outline of the cut section. This done, see that you mark also the hollow of the stem if it is hollow, and then proceed to colour the gills of the natural colour, if they are not white, and then the inner surface of the stem, or wherever colour is requisite to a perfect section. Having a perfect and accurate section, you have obtained half of what is necessary. Lay the same, or the other half, on the paper, and trace again in the same way; but, instead of tracing the gills, leave off at the edge of the cap, remove your section, draw a connecting line across from one edge to the other of the cap, and you have an outline of the growing fungus, drawn mechanically. Colour this also as near as you can in imitation of the living specimen. By getting over the difficulty of drawing by this method, the minor difficulty of colouring will soon be overcome, and, after a time, the mere tracing will so accustom the hand that you will be able to accomplish artistic drawing.

On these rough drawings may be written all the details which could not be well represented. It may be necessary in your earliest attempts to write the name beneath; you should add where found, if on the ground or on wood, whether it was viscid or dry, dull or shining, fœtid, or without odour, etc. These, roughest of all drawings, will serve to remind you of all the features of species you have seen. Take special care to omit nothing that you can see and recognise in the living plant. If you wish to preserve the spores you can obtain them in the method already described, and, folding the paper so as to prevent their rubbing off, attach them to your sketches.

For a few minutes permit me now to answer the question which some one might propound—"Cui bono?"

There is less asking of such a question now in respect of any natural history pursuit than there was forty years ago. You must apply for yourselves all such general answers as will apply to *all* the departments of Biology.

I will attempt only two or three, which are special to the subject. First,—The field is so little trodden that you are sure to bring credit to yourself by your investigations; and you will probably soon receive encouragement by some discovery, either of new forms or new phases, such as the well-worked entomology could not so readily furnish. Secondly,—Your acquisition of practical knowledge may add very considerably to your creature comforts. Taking, as a low estimate, fifty species found in this country to be good eating—and some are delicious—you will be able to add a few choice dishes to your table, and to invite your friends to repasts of which they had not before tasted. I have never recommended anyone to experiment with fungi, but I *do* recommend those who are able with certainty to distinguish one fungus from another, as readily as they can distinguish a chaffinch from a crow, to eat such as are edible, because no two of them are exactly alike, and some of them will produce quite a new sensation, and will remain a standing dish at your table for ever after. Eight or nine gentlemen of my acquaintance once supped with me, now twenty years ago. They were beguiled to eat of a mysterious dish. It was fried puff-ball. Not one of them now living has forgotten that supper, and it is almost always mentioned when we meet, for meetings are rare with old friends, and the reminiscence always affords pleasure, as did the repast.

Prejudice is very strong against eating any fungus but that called the Mushroom, and yet I suppose that I have eaten forty others which are quite as harmless, some quite as good, others perhaps better, and all quite as easy of determination—some more easy, for they can scarcely be mistaken.

I think a successful appeal to an Englishman's stomach needs no further answer to "what good is it?" I must now crave permission to conclude with a word or two of counsel.

Do not imagine that there is any royal road to the knowledge of fungi. The only road is patience and perseverance.

Do not despair because you fail ten times in determining a fungus accurately, for many have failed before you.

Do not rest satisfied with having your specimens named for you. It is better to make out a few for yourself than only to learn them empirically by being told their names, and never learning the reason why. It is useful to have a few species pointed out, or a difficult problem solved; but this being done, the next step should be to compare the specimens carefully with the description in the book, and see how the two things agree. Never take upon trust what is told you, if you have the opportunity of verifying for yourself. The road to truth runs through the portals of doubt.

In my experience I have known many who call themselves naturalists, who collect a batch of specimens, trouble themselves not for an instant to determine what they are, but pack them off at once to some expert, with a polite note, "Please to inform me of the names of the enclosed." Such a proceeding is not only a disgrace to any intelligent man, but it is also a shameful tax on the energies of the too willing expert, who, like a true naturalist, is ever willing to extend a helping hand. I have known persons to follow this process year after year, sending the same common thing three or four times over, and even after ten years not a step beyond the point from whence they started.

It is only we, who follow a specialty, who know the extent to which this brass is passed as gold. Depend upon it, we can form our estimate of men who make collections, and borrow reputations, at the cost of other men's brains.

Do not imagine that you are failing because you cannot appraise your own success. You may seem to stand still, and yet, if your work is earnest and genuine, you will be progressing. Acquisition of knowledge can never be set down as a failure ; and one cannot cut up and examine plants, whether fungi or others, one after another, and not acquire knowledge. True knowledge is not showy and pedantic. A little popgun may make a great noise.

Do not attempt too much. Confine your operations to some definite limit. Let the Agarics, for instance, be the summit of your ambition, and do not attempt more till you comprehend the method of classification, and have laid a good foundation; then you may go on and add another story to your house. Attempting too much means failure in all. You know what we think of a man who knows a little of everything—the title of every book, the mysteries of every trade. We know also the success which men have achieved by confining themselves to a small group of insects, to a single order of plants, and how easy it is for them to add another, and another, when they have learnt one thing well.

THE BIRDS OF LEICESTERSHIRE.

PART I.—OUR SUMMER MIGRANTS.

BY THOMAS MACAULAY, M.R.C.S.L., ETC.

A tolerably complete list of the Summer Migrants of this county will, I hope, be interesting to some of the readers of the "Midland Naturalist." Harting, in his very able work on the subject, enumerates forty-nine species, but of these, two, namely, the Meadow Pipit, *(Anthus pratensis,)* and the Rock Pipit, *(Anthus obscurus,)* are, I believe, constant residents, and I therefore propose to omit them altogether from my list; two others, the Stonechat *(Saxicola rubicola)* and the Pied Wagtail *(Motacilla yarrelli,)* are only partial migrants, some of each species undoubtedly remaining with us during every winter, and for this reason they also will be omitted. I must also erase from Harting's list, the Gray Wagtail *(Motacilla boarula,)* because it is a *winter* and not a summer migrant. There is also a considerable number of so-called summer migrants in Harting's book, which, although no doubt migratory, and which, when observed in this country, are only seen in summer, yet their advent is so rare that I prefer to give them a place to themselves, under the head of "Rare and Occasional (Migratory) Summer Visitors." These are fifteen in number, a list of which will be given at the close of this paper, with attention to the few species among them which alone have, so far as I know, been observed in this county. Further, there will be found in my list five species which are not included in Harting's, but which I think he would admit are true summer migrants. These are the Ring-ouzel *(Turdus torquatus,)* the Quail, *(Tetrao coturnix,)* the Hobby *(Falco subbuteo,)* the Common Sandpiper *(Tringa hypoleucos,)* and the Garganey *(Anas circia.)* Taking, then, Harting's list as a basis, there will be found, after the deductions and additions above-mentioned, that thirty-four species remain, every one of which has been observed and noted, either by myself, or by my esteemed friend, the Rev. A. Matthews.

1.—First on the list, because almost invariably the first to arrive, is the Chiff-chaff, *(Sylvia rufa.)* The earliest record I have of its arrival is in 1880, when it was heard on March 19th. The average date would be March 25th.

2.—The Black-cap *(Sylvia atricapilla)* follows closely on the heels of the Chiff-chaff, usually arriving in the first week of April, and on one occasion, in 1877, I heard its lovely song on March 24th.

3.—The Willow Wren, *(Sylvia trochilus,)* always numerous, is first heard and seen during the first three weeks of April. I have found it as early as the 6th and as late as the 21st.

4.—The Wheat-ear, *(Saxicola œnanthe.)* Scarcely a season passes without my seeing one or more, but they are not common. They come to us about the last week of March or the first week of April. In 1880 I noticed them on March 25th, and this year on April 15th.

5.—The Swallow, *(Hirundo rustica.)* With what wonderful regularity this bird appears year by year, will be seen by the fact that in my notes, extending over many years, my earliest date is April 11th, and my latest April 18th.

6.—The Martin, *(Hirundo urbica.)* Somewhat more uncertain than the last-named, the Martin arrives in the last fortnight of April. I have notes of its appearance from the 14th to the 30th.

7.—The Sand Martin, *(Hirundo riparia.)* Within a few yards of my house is a large sand pit, where numbers of these birds breed every year, and as I never fail to visit it twice daily when on the look out for their arrival, I am able to get the exact date. This I have found to vary from the 10th to the 25th April. They depart at the latter end of August.

8.—The Swift, *(Cyplesus apus.)* Last of the Hirundines to arrive and the first to leave. Its arrival varies from the first to the third week in May, as early as the 5th, (1878,) and as late as the 16th, (1874,) the average date being 12th. They also leave us at the latter end of August.

9.—The Wryneck, *(Yunx torquilla.)* Not very common, but seen and heard most years. It arrives some time in April, as early as the 7th and as late as the 24th. My note-book says:—"A pair built this year in a neighbouring garden, and were not disturbed, so that we may hope, thanks to the new Act, to see them more plentiful."

10.—The Garden Warbler, *(Sylvia hortensis.)* A constant visitor, putting in an appearance in the last week of April, or the first week of May.

11.—The Whitethroat, *(Sylvia cinerea.)* About the same date as the Garden Warbler. The Whitethroat is found in our lanes from April 22nd to May 6th.

12.—The Lesser Whitethroat, *(Sylvia curruca.)* Earlier than either of the two last species. This bird arrives in the second or third week in April. I have only one record in the last week, the others range from the 11th to the 16th.

13.—The Yellow Wagtail, *(Motacilla Raii.)* This, the loveliest in appearance of all the summer migrants, arrives during the last fortnight in April. My own observations extend between the 19th and 28th.

14.—The Nightingale, *(Philomela luscinia.)* Every year we are favoured by the visits of several of these kings of song. April 20th is about the average date, as early as the 14th and as late as the 25th. Their song ceases about the end of the second week in June.

15.—The Cuckoo, *(Cuculus canorus.)* Somewhat uncertain as to date, as early as April 7th and as late as May 2nd. Its note is generally heard for the last time early in July.

16.—The Grasshopper Warbler, *(Avicula locustella.)* Always heard, but very seldom seen. It arrives usually in the first week in May. I have heard it as early as April 23rd. The only time I have seen it was when a pair built under a bush in the garden at Gumley Rectory, and when the young were hatched I contrived to obtain a good view of the old bird when engaged in feeding the young.

17.—The Sedge Warbler, *(Salicaria Phragmitis.)* Very common. Appears from the middle of April to the end of the first week in May. Their song ceases towards the end of July.

18.—The Redstart *(Ruticilla phoenicurus.)* Not very common. A few seen most seasons, generally about the latter end of April, or first week in May.

19.—The Tree Pipit, *(Anthus arboreus.)* Another regular visitor, arrives about the last week, or from 21st to 31st of April.

20.—The Wood Wren, *(Silvia sibilatrix.)* Rare. I have only one observation of it. In 1879, it was seen in Gumley Wood by Rev. A. Matthews, whose intimate acquaintance with birds, both in this county and for many years previously in Oxfordshire, is a sufficient guarantee for the correctness of the note.

21.—The Whinchat, *(Pratincola rubetra.)* In no great abundance, but seen most seasons, about the last week in April.

22.—The Spotted Flycatcher, *(Muscicapa grisola.)* One of the latest of the summer migrants to arrive, not appearing till the first week in June, but still a regular visitor. There was a nest in my garden during the past summer.

23.—Pied Flycatcher, *(Muscicapa atricapilla.)* Very rare. Only seen once during twenty-five years observation, in 1870.

24.—The Landrail, *(Crex pratensis.)* The neighbourhood does not seem attractive to them, but a few come every year; not often heard till the first week in June, though I have seen a specimen in the bird-stuffer's hands as early as April 29th. No doubt they are here some time before they make themselves known.

25.—The Nightjar, *(Caprimulgus Europæus.)* I have never seen this bird alive myself, but my friend, Rev. A. Matthews, has observed it on several occasions on the outskirts of Gumley Wood.

26.—The Redbacked Shrike, *(Lanius Collurio.)* Not very common, but a few specimens are usually to be seen. They appear about the first week in May.

27.—The Turtle Dove, *(Columba turtur,)* though not in any number, yet visits us regularly every summer, and breeds here.

28.—The White Wagtail *(Motacilla alba)* comes and departs with *Motacilla Raii.* Has been more abundant of late years.

29.—The Reed Warbler, *(Salicaria strepera.)* I have never seen this bird in this part of the county, for the sufficient reason that there are no reed beds in the neighbourhood; but my friend, Rev. A. Matthews has seen and heard it in the northern division of Leicestershire, when he has been insect hunting, so that I claim a place for it among the Leicestershire migrants.

30.—The Ring Ouzel, *(Turdus torquatus.)* Very uncommon. The only record I have is "one shot May, 1871, by the keeper, in Gumley Wood." It is now in the collection of Rev. A. Matthews.*

31.—The Quail *(Coturnix communis)* used to be more frequently met with years ago. Yet it is still sometimes found.

32.—Common Sandpiper *(Totanus hypoleucos.)* Seen regularly every summer. Breeds at the Saddington Reservoir.

33.—The Hobby *(Falco subbuteo)* has been noted on several occasions at Gumley Wood, by Rev. A. Matthews. A male was shot April, 1880, at Rothley, and is now in my collection.

34.—The Garganey, *(Anas circia.)* Rare. I shot four at Saddington Reservoir, in July, 1868.

* Since the above was in type, I have heard of two more specimens of the Ring Ouzel, one at Gumley and one at Nosoley.

The last-named bird closes the list of summer migrants proper, and there remain to be noticed fifteen species, which I prefer to call

RARE AND OCCASIONAL (MIGRATORY) SUMMER VISITORS.

The Orphean Warbler.
Savis' Warbler.
The Aquatic Warbler.
The Marsh Warbler.
The Great Reed Warbler.
The Rufous Warbler.
Richard's Pipit.
The Tawny Pipit.
The Pennsylvanian Pipit.
The Redbreasted Pipit.
The Water Pipit.
The Alpine Swift.
The Hoopoe.
The Golden Oriole.
The Grey-headed Wagtail.

Of these, as far as I can ascertain, only four species have been found in this county. Harting says he has a specimen of the Aquatic Warbler, killed near Loughborough, in 1864. The same author mentions the occurrence of the Alpine Swift on September 23rd, 1839; and he gives this note on the authority of Macgillivray. In the Leicester Museum are two specimens of the Hoopoe, killed near Leicester, in July, 1865, and finally, I observed the Grey-headed Wagtail near Kibworth on May 2nd, 1880.

Of the remaining eleven species, I am unable to say whether they have been seen or taken in the county. There are specimens in the Leicester Museum of the Orphean Warbler, Savis' Warbler, Rufous Warbler, Richard's Pipit, Water Pipit, and Golden Oriole, but there is nothing to show whether they were locally obtained or not.

I have thus accounted for thirty-eight species out of forty-nine. It may happen that some of the other rare ones have been observed, and if so, I shall be very glad if any of your readers can supply me with the information, so as to make the list complete.

I propose, in a future paper, to deal with the Winter Migrants and Winter Visitors of the county, and then to enumerate the constant residents.

THE MINERALS OF THE MIDLANDS.

BY C. J. WOODWARD, B.SC.

Mr. H. B. Woodward, of the Geological Survey, has been good enough to send me the following list:—

GLOUCESTERSHIRE.

Agate	Berkeley, Damory Bridge	Igneous rock.
Barytes (Heavy Spar)	Tortworth	Igneous rock.
Bitumen ..	Clifton . ..	Carboniferous Limestone.
Brown Spar ..	Tortworth	Igneous rock.
Celestine ..	Tortworth, Thornbury, Wickwar, Aust	Igneous rock, Carboniferous Limestone, New Red Marl.

Fluor Spar ..	Clifton	Carboniferous Limestone.
Göthite	Clifton	Dolomitic Conglomerate.
Jasper	Tortworth	
Prehnite ..	Woodford Bridge, Berkeley	Igneous rock.
Rock Salt (pseudomorphs) ..	Aust	Igneous rock.
Steatite ..	Tortworth	Igneous rock.
Talc	Tortworth	Igneous rock.
Vivianite ..	Near Clifton ..	Alluvium.

Enumerated by H. B. Woodward, Geology of East Somerset and the Bristol Coal-Fields (Mem. Geol. Survey), pp. 176, 177. The mineralogical characters of the Basalts from Charfield Green and Damory are described by Mr. F. Rutley on pp. 210-212 of the same work.

LEICESTERSHIRE.

Mr. W. J. Harrison, F.G.S., Science Demonstrator for the Birmingham School Board, has sent me the following note:—"Gold* occurs in the quartz veins round Peldar Tor, a craggy pinnacle in the north-west part of Charnwood Forest. The point is very near one of the old volcanic foci from which the ashes which form the Charnwood slates were ejected."

Mr. Harrison discovered garnets in the gneiss of Charnwood Forest, and thus refers to them in the "Midland Naturalist," Vol. II., p. 77:—"To-day, in minutely examining some specimens collected last summer, I was pleased to find many small garnets in the curious rock we call gneiss, which is found at one point only, viz., Brazil Wood, about half-way between Mount Sorrel and Swithland. . . . The garnets are very small (not more than one-tenth of an inch in diameter), almost black in colour, and so thickly crowded that there are about fifty in a square inch."

Mr. James Plant, F.G.S., of Leicester, has sent the following list:—

Copper Pyrites .. / Molybdenum ..	Mount Sorrel and Breedon	Granite.
Galena .. .. / Blende	Diminsdale	Mountain Limestone.
Dolomite ..	Cloud Hill	Mountain Limestone.
Gypsum .. / Selenite ..	Various places.	

Marcasite is found in the vertical fissures of the coal, and also in the "binds," at Whitwick, Elliston, and Bagworth Collieries.

Iron Pyrites in cubes, one-eighth in side, at Swithland Great Pit, embedded in the slate *not* in line of bedding.

Tin Stone found some years ago in the streams at Tin Meadows, near Whitwick, Charnwood Forest, as Stream Tin.

Mr. Wm. Stukeley Gresley sends the following references to works bearing on the minerals of Leicestershire:—Hull's "Coal Fields of

* Discovered by Mr. How. Incidentally mentioned by the President of the Geological Society. See "Quarterly Journal, Geological Society," XXXVI., p. 350.

Great Britain;" Mammatt's "Geological Facts;" White's "Leicestershire;" Harrison's "Geology of Leicestershire and Rutland;" Page's "Economic Geology," p. 206.

NORTHAMPTONSHIRE.

Mr. Thomas Beesley, F.C.S., has sent me the following list:—

MINERALS OCCURRING IN THE NEIGHBOURHOOD OF BANBURY (OXFORDSHIRE AND NORTHAMPTONSHIRE.)

Lignite	In Middle and Upper Lias clays and marls.
Baryte	With Blende in the middle of calcareous claystone concretions in ditto.
Gypsum, var. Selenite.	In the same clays and marls: especially fine in the Upper Lias of Milcomb Hill and Hooknorton (railway cutting).
Calcite	In limestone (joints, etc).
,, var. Calcareous Tufa.	
,, var. Lac Lunæ	In Oolite clays derived from fossil shells.
Websterite	A subsulphate of Aluminium, deposited from aluminous springs arising in the Lias clays. (See paper by me in "Pharmaceutical Journal," 1st series, Vol. IX., p. 452).
Pyrite	In the clays and marls; often filling fossil shells.
,, var. Marcasite	The same.
Limonite	In the marlstones and marls, as well as in the sandy beds of the Inferior Oolite, where it seems to have replaced Pyrite.
,, var. Yellow Ochre ..	In joints at the top of the "marlstone," washed in from the Upper Lias.
,, var. Bog Iron Ore.. ..	A large lump was found close to the Great Western Railway at Twyford, three miles south of Banbury. It enclosed some bronze articles apparently Anglo-Saxon. One was probably the pommel of a sword-hilt, as it contained a bit of iron; and the blade may have contributed to the lump of oxide.
Glauconite	The green grains of the "marlstone"—possibly casts of entomostracans.
Vivianite	Bright blue granules disseminated in the lower marly clay of the Margaritatus zone; found in making a sewer near my house in the High Street, Banbury. Not far from it were many old bones, probably buried centuries ago.
Manganese oxide ..	Small black grains, disseminated in a thin sandy Limestone, which here, as in Normandy, is a passage-bed from the Spinatus Zone to the Upper Lias. They are most plentiful in the interior of fossil shells, and give quite a grey tint to the otherwise cream-coloured mass. It may be an impure *psilomelane*.

Blende	Occurring usually with Baryte, in the middle of calcareous claystone nodules.
Galena	Is said to occur in such nodules; but in my experience the small crystals having the look of this have always proved to be Blende.
Quartz	Vein as well as quartzite, and its varieties, Jasper, Cornelian, Chert, and Flints, occur plentifully in the "drift;" but I have not met with them excepting as derivate minerals.
Lydite	The same applies.
Mica	Occurs in small spangles in the sandstones and clays; but of this the same may be said.
Phosphate of Lime ..	Calcareous nodules sometimes contain a large proportion of this; and they deserve a mineralogical name quite as much as the Boles and the Ochres, and other such matters.

THE FLORA OF WARWICKSHIRE.

AN ACCOUNT OF THE FLOWERING PLANTS AND FERNS OF THE COUNTY OF WARWICK.

BY JAMES E. BAGNALL.

(Continued from page 242.)

GERANIACEÆ.

GERANIUM.

G. phæum, *Linn.* *Dusky Crane's Bill.*

Alien: In woods and by roadsides. Rare. May.

I. Arley Wood, *W. B. Grove*; abundant in Pool Hollies Wood, Sutton Park, as late as 1869, exterminated now; Middleton Road, near Moor Hall Grounds, 1868; a casual there, I think.

II. In a wood near Coton House, *Kirk, Phyt.* ii., 969; between Lawford and Dunchurch, *R.S.R.*, 1874.

G. sylvaticum, *Linn.* *Wood Crane's Bill.*

Native: In woods. Very rare. "June."

I. Wood near Middleton, *C. Adcock*, 1866. A specimen from a wood in this district was shown me by the late Charles Adcock in 1866.

II. Oversley Wood, *Purt.*, i., 320. I have carefully searched Oversley Wood several seasons for this plant without success. Purton does not appear to have had a specimen of this plant from the Oversley habitat in his herbarium.—"Reported from Warwickshire," *Syme, E. B.*, ii., 194.

G. pratense, *Linn.* *Meadow Crane's Bill.*

Native; In fields and by roadsides. Locally common. June, July.

I. Meadows, near Polesworth, *J. P. M. S., note in B. G.*; canal bank, near Knowle.

II. Allesley, *Hylesford, B. G.*, 635; not rare in the neighbourhood of Warwick, *Perry Fl.*, p. 58; Whitnash, Chesterton! Radford, *Y. and B.*; near Rugby, *Rev. A. Blox.*; Blackwell, Tredington, Honington, Lambcote, *Newb.*; Brandon; Temple Grafton; Little Alne; Henley-in-Arden; Bearley; Drayton Bushes; between Edge Hill and Kineton.

G. pyrenaicum, *Linn.* *Mountain Crane's Bill.*
Alien: In pastures and by roadsides. Very local. June to August.
I. Allesley! Coleshill! *Bree., Mag. Nat. His.*, iii., 165, *N. B. G.*; Harborn, *Freeman, Phyt.*, i., 262; Birmingham Road, near Bacons End, Coleshill, 1878.
II. Myton, Tachbrook, Kenilworth, *Y. and B.*

G. molle, *Linn.* *Doves-foot, Soft Crane's Bill.*
Native: On banks and in pastures. Common. March to September. Throughout the whole area. There are at least two marked varieties.

G. pusillum, *Linn.* *Small-flowered Crane's Bill.*
Native: On heathy waysides and banks. Local. April to July.
1. Sheldon, 1835, *Rev. J. Gorle*; on banks Middleton Road from Sutton; pathway from Marston Green to Chelmsley Wood; Old Chester Road, near Tyburn; Maxtoke Park.
II. Kenilworth, *Y. and B.*; abundant on heathy footway, near Great Alne; near Brandon, on the road leading to Brinklow; meadows near Bishopton.

G. dissectum, *Linn.* *Jagged-leaved Crane's Bill.*
Native: On banks in fields, &c. Common. May to August. Common through the whole area.

G. columbinum, *Linn.* *Long-stalked Crane's Bill.*
Native: On banks, by roadsides, and in fields. Rather rare. June to August.
I. A few plants at the north end of Sutton Park, 1877.
II. Wixford Lane, *Purt.*, i., 321; opposite the Windmill Inn, on the Stratford Road, from Warwick, *Perry*, 1817; Morton Morrell, *Y. and B.*; Lighthorne, Wellesbourne, *Bolton King*; near the Golden Cross Inn, Exhall; near Alcester, abundant, 1877; bridle road between Binton and Red Hill, in a corn field, abundant, 1877; road from Brandon to Brinklow.

G. lucidum, *Linn.* *Shining Crane's Bill.*
Native: On old walls and banks. Locally common. April to August.
I. On walls, near Fillongley Hall; near Oldbury Hall; Arley village; road to Minworth from Water Orton.
II. Warwick and Kenilworth, *Purt.*, i., 320; between Warwick and Longbridge, Stankhill, and near Warwick Racecourse, *Perry, Fl.*, p. 58; Kenilworth, *Y. and B.*; Bilton Road, near Rugby, *R. S. R.*, 1877; lanes about Allesley, abundant; Stratford Road, from Warwick, abundant; near Rowington Church.

G. Robertianum, *Linn.* *Herb Robert.*
Native: On banks, walls, and waste places. Common. April to September.
Common throughout the county.

[**G. sanguineum,** *Bloody Crane's Bill*, is recorded as an escape from cultivation, near Holbrook Grange, Rugby, *R. S. R.*, 1868, p. 47.]

[G. **striatum**, *Linn*, *Pencilled Geranium*, is also recorded as naturalised in a spinney, near Rugby Mill, *R. S. R.*, 1867; near Chesford Bridge, Kenilworth, *J. G. Perry*, 1829, *Herb. Perry*; coppice, near Roman Catholic College, Kenilworth, *H. B.*]

ERODIUM.

E. cicutarium, *Herit.* *Stork's Bill.*

Native: In fields, on sandy banks, and by roadsides. Rather rare. April to August.

I. Slade Lane, Witton; field, near Erdington; Coleshill Heath; Sutton Park; Marston Green.

II. In a sandy field, by the Aqueduct, near Warwick, *Perry, Fl.*, 57; old walls, Kenilworth, *Y. and B.*; Emscote, Woodloes, *H. B.* Plentiful in pastures near Brandon.

Two varieties occur in the county. Var. *a* appears rare; I only find it on Coleshill Heath. Var. *b*, *chærophyllum*, a more rampant form, is our most frequent plant.

E. moschatum, *Herit.* *Musk Stork's Bill.*

Native: On marly banks. Very rare. "May."

II. Cookhill,* on the Ridgeway, *Purt.*, i., 316; stone quarry, Warwick; near Mill Pool, Berkswell; Scar Bank, Hampton Lucy, *H. B.*

[**E. maritimum**, *Sm.*, has been found for several seasons on a bank near Oscott College! by the Rev. J. Caswell. His specimens are true *E. maritimum*, but the plant cannot be more than a casual in such a locality.]

OXALIS.

O. Acetosella, *Linn.* *Wood Sorrel.*

Native: In woods and on shady banks. Locally common. April to May.

Spread throughout the whole area. Stated in Rugby School Report to be rare near Rugby, 1877. Mr. Bromwich finds a variety, with rose-colour flowers, in Poors Wood, Wroxall; and I find the same variety in Bush Wood, Lapworth, abundant.

The apetalous flowers are abundant all through the season.

[**O. corniculata**, *Linn.*, in a garden at Foleshill, *Kirk, Phyt.*, ii., 969. This plant is so constantly cultivated as to be scarcely worth notice here had it not been for Mr. Kirk's record.]

[**O. stricta**, *Linn.*, waste ground, Arbury Hall, *Kirk.*, *Herb. Brit. Mus.*; in gardens about Myton and Kenilworth, *H. B.*; is also a mere remnant from cultivation.]

[**Impatiens Noli me-tangere**, *Linn.*, near Berkswell, *Cox*, *spec. Herb. Perry*, must also be placed under the same category.]

ILEX.

I. Aquifolium, *Linn.* *Holly.*

Native: In woods, copses, and hedges. Common. May.

This is common throughout the county, but is often planted.

CELASTRACEÆ.

EUONYMUS.

E. europæus, *Linn.* *Spindle Tree.*

Native: In hedges, copses, and woods. Local. June.

I. Coleshill, *Bree.*, *Purt.*, iii., 347.

* Cookhill is quoted by Perry as a Warwickshire station; it is, however, in Worcestershire, on the very border of Warwickshire.

II. Oversley Wood! Wetherley Wood. *Purt.*, i., 132; Morton Morrell, *Y. and B.*; Chesterton, Lighthorne, hedge, near Kenilworth, *H. B.*; plentiful about Ipsley! *J. T. Slatter*; Cold Comfort, near Alcester; hedges, near Alveston Pastures.

RHAMNACEÆ.

RHAMNUS.

R. catharticus, *Linn.* *Buckthorn.*

Native: In woods and hedges. Locally common. May, June.

I. Packington, *Aylesford*, *B. G.*, ii., 634; Coleshill, *Bree.*, *Mag. Nat. Hist.*, iii., 163; near Knowle Station.

II. Bidford, *Purt.*, i., 130; Radford, *Perry*, *Fl.*, p. 22; Styvichall, 1854, *Kirk*, *Herb. Brit. Mus.*; Moreton, Hampton Lucy, *Y. and B.*; Myton, Tachbrook, *H. B.*; Pinley, *Kirk.*, *Phyt.*, ii., 949; at Langley, in the parish of Claverdon, *Bree*; Honington! Tredington, *Newb.*; Bilton, *R. S. R.*; Lighthorne, *Bolton King*; Drayton Bushes; Brandon; Brinklow; Ipsley.

R. Frangula, *Linn.* *Black Alder.*

Native: In woods and hedges. Locally common. May, June.

I. Abundant in Sutton Park; Coleshill Heath; Trickley Coppice.

II. Grafton! Arrow, Great Alne, *Purt.*, i., 131; woods at Hatton, *Perry*, *Fl.*; Coventry Wood, Arbury Deer Park, *Kirk*, *Phyt.*, ii., 969; Chesterton! Oakley Wood! *Y. and B.*; Haywoods; Brinklow; Brandon.

(To be continued.)

METEOROLOGY OF THE MIDLANDS.

THE WEATHER OF SEPTEMBER, 1881.

BY CLEMENT L. WRAGGE, F.R.G.S., F.M.S., ETC.

The conditions of September are soon noted. It was a typical month of early Autumn. Fogs and heavy dews were prevalent in the mornings, but the weather was generally fine, and favourable for the ripening and ingathering of the late corn harvest. Singularly enough, in the neighbourhood of Melton Mowbray and other parts of Leicestershire, the rainfall was considerably heavier than in our other counties, and harvesting operations suffered in consequence. This was also the case in the vicinity of Scarborough, and the excessive rain there caused the grain to sprout. Three barometric depressions were recorded, viz., on the 6th, 18th, and 21st, thunderstorms accompanying that of the 18th. Temperature was below the average at Mansfield by 2.3, and at Orleton by 1.5. Duration of sunshine at Hodsock 87.7 hours. Extreme values from radiation instruments:—Solar, 129.0 on 17th, and terrestial 30·8 on 29th, at Burton and Marlborough respectively. Mean sea temperature at Scarborough 54.0.

Notes by Observers.—*Cheltenham.*—Fruit ripe much earlier than last year; leaves falling much sooner. *Woolstaston.*—Swallows left about 19th. *Burton.*—Chestnuts and limes, as also at Cheltenham, bare very early. *Alstonfield.*—Swift remained unusually late; two pairs as late as September 6th. *Linacre.*—Primroses in bloom on 24th; crocus on 25th. *Oxford.*—Lunar corona seen on 6th. *Fort William.*—Only two wasps noticed during the entire season in this locality, one of which was taken about 25 feet from the top of Ben Nevis.

STATION.	OBSERVER.	RAINFALL.				TEMPERATURE.			
		Total for M.	Greatest fall in 24 hours.		No. of rainy d.	Greatest ht.		Greatest cd.	
		In.	In.	Date.		Deg	Date.	Deg	Date.
OUTPOST STATIONS.									
Ben Nevis (a)*	C. L. Wragge, Esq., F.M.S.	6·09	1·26	29	22	49·8	11	28·4	2
Fort William (a)	C. L. Wragge, Esq., F.M.S	2·01	·41	25 & 29	16	63·3	20	37·7	15
Spital Cemetery, Carlisle	I. Cartmell, Esq.	2·34	·62	17	11	68·8	30	38·4	16
Scarborough (a)	F. Shaw, Esq., F.M.S.	4·95	1·82	21	16	68·3	18	44·5	17
Blackpool (a)—North Shore						66·6	20	44·1	2
South Shore	C. T. Ward, Esq., F.M.S.	2·50	1·04	24	14	66·0	20	39·8	17
Llandudno (a)	J. Nicol, Esq., M.D., F.M.S.	·98	·23	17	13	64·4	29	46·2	16
Lowestoft (a)	S. H. Miller, Esq., F.R.A.S.	2·96	·66	2		66·0	19	37·7	29
Carmarthen (a)	G. J. Header, Esq., M.D.	2·71	·62	25	13	65·6	16	37·9	16
Altarnun, Cornwall	Rev. J. Power, M.A.	2·97	1·18	5	14	72·0	18	36·0	1
Sidmouth (a)	W. T. Radford, Esq., M.D.	2·55	1·39	5	13	66·9	18	44·1	1
St. Augustine's, Ramsgate (a)	Rev. T. E. Egan, O.S.B.	3·34	·88	10	18	66·2	7	47·5	16
MIDLAND STATIONS									
GLOUCESTERSHIRE.									
Cheltenham (a)	R. Tyrer, Esq., F.M.S.	1·66	·49	24	14	71·2	18	35·7	16
WILTSHIRE.									
Marlborough (a)	Rev. T. A. Preston, F.M.S.	1·84	·71	24	12	74·7	18	37·0	16
SHROPSHIRE.									
Woolstaston	Rev. E. D. Carr	1·74	·57	20	18	66·5	18	41·0	2
More Rectory	Rev. A. S. Male	1·82	·41	24	18	68·0	19	36·0	15
Bishop's Castle	E. Griffiths, Esq.	2·01	·4	24	15	68·0	15	39·0	21
Dowles, near Bewdley	J. M. Downing, Esq.	1·86	·6	24	7	81·0	8	30·0	17
HEREFORDSHIRE.									
Stoke Bliss	Rev. G. Alexander	1·79	·47	24	15	71·0	22	40·0	30
WORCESTERSHIRE.				24					
Orleton, Tenbury	T. H. Davis, Esq., F.M.S.	1·95	·56	24	17	70·7	18	36·0	17 & 29
West Malvern	A. H. Hartland, Esq.	2·28	·64	5	15	74·0	18	43·5	15
Evesham	T. J. Slatter, Esq., F.G.S.	1·56	·48	24	11	70·0	18	39·5	29
Cawney Bank, Dudley	Mr. C. Beale	1·20	·45	20	21	67·0	18	42·0	1
STAFFORDSHIRE.									
Dennis, Stourbridge (a)	C. Webb, Esq.	1·42	·42	24	12	73·0	18	37·0	28 & 30
Kinver	Rev. W. H. Bolton	1·63	·47	24	15	70·0	18	36·0	28
Lichfield	J. P. Roberts, Esq.	1·98	·43	24	14	68·0	18	35·0	27
Grammar School, Burton	C. U. Tripp, Esq., M.A.	1·77	·44	24	19	74·0	17 & 18	35·0	17
Weston-under-Lyziard	Hon. & Rev. J. Bridgeman	1·75	·5	24	20	70·0	18	37·0	17
Wrottesley (a)	E. Simpson, Esq.	1·76	·52	24	16	67·8	18	39·8	28
Tean	Rev. G. T. Ryves, F.M.S.	2·22	·65	24	15	68·0	18	34·0	17 & 29
Heath House, near Cheadle (a)	J. C. Philips, Esq., J.P.	1·81	·58	24	14	66·5	18	39·6	2
Oakamoor (a)	Mr. E. E. Kettle	1·82	·66	24	18	68·2	28	32·5	17
Beacon Stoop, Weaver Hills (a)	Mr. James Hall	1·60	·40	24	19	61·7	18	36·9	2
Alstonfield	Rev. W. H. Purchas	2·50	·56	24	17	69·8	18	31·4	17
WARWICKSHIRE.									
St. Mary's College, Oscott (a)	J. MacElmail, Esq.	1·28	·42	24	9	75·3	18	40·2	28
Henley-in-Arden	T. H. G. Newton, Esq.	2·14	·70	24	16	74·5	18	37·0	28 & 29
Park Hill, Kenilworth (a)	T. G. Hawley, Esq.	1·68	·57	24	17	72·1	18	35·0	29
Kenilworth (a)	F. Slade, Esq., C.E., F.M.S.	1·92	·59	24	16	73·1	18	35·6	29
Coundon, Coventry	Lieut.-Col. R. Caldicott	2·15	·65	24	16	70·0	18	41·0	28
Rugby School	Rev. T. N. Hutchinson	1·81	·62	24	18	73·6	18	39·6	29
DERBYSHIRE.									
Stony Middleton	Rev. U. Smith	2·36	·75	24	13	67·0	7	32·0	16 & 17
Linacre Reservoirs	C. E. Jones, Esq.	1·75	·46	24	15				
Duffield	W. Bland, Esq.	1·63	·55	24	14				
NOTTINGHAMSHIRE.									
Mansfield (a)	W. Tyrer, Esq., F.M.S.	1·81	·39	22	19	70·8	18	37·0	17
Park Hill, Nottingham	H. F. Johnson, Esq.	1·73	·42	24	11	64·5	20	40·0	27
Hodsock Priory, Worksop (a)	H. Mellish, Esq., F.M.S.	1·84	·40	22	19	73·3	18	37·3	28
Tuxford	J. N. Dufty, Esq., F.G.S.	1·70	·27	24	15	62·0	20	38·0	17 & 30
LEICESTERSHIRE.									
Loughborough (a)	W. Berridge, Esq., F.M.S.	1·75	·45	24	16	74·9	18	35·1	17
Syston	J. Hames, Esq.	2·14	·49	24	20	73·0	19	37·0	29
Ashby Magna	Rev. Canon Willes	2·89	1·00	18	18	74·0	18		
Kibworth	T. Macaulay, Esq.	2·63	·63	18	17	70·0	18	40·0	16
Waltham-le-Wold	Edwin Ball, Esq.	2·66	·35	6	17	62·0	18	42·0	27
Dalby Hall	G. Jones, Esq.	2·58	·42	5	16	76·0	18	36·	28
Coston Rectory, Melton (a)	Rev. A. M. Rendell	2·43	·51	6	20	72·0	18	35·1	29
NORTHAMPTONSHIRE.									
Towcester	J. Webb, Esq.	1·47	·43	24	13				
Kettering	J. Wallis, Esq.	1·58	·61	24	14	66·0	19 & 21	42·0	29
Althorp	C. S. Groom, Esq.	1·71	·72	24	14	71·0	18	35·	30
OXFORDSHIRE.									
Ratcliffe Observatory, Oxford	The Staff	1·39	·70	24	15	74·	19	36·9	29
RUTLAND.									
Northfields, Stamford	W. H. Hayes, Esq.	2·28	·40	18	16	65·0	4	35·	29
Uppingham (a)	Rev. G. H. Mullins, M.A.	2·28	·61	24	15	72·4	18	42·3	17

(a) At these Stations Stevenson's Thermometer Screen is in use, and the values may be regarded as strictly intercomparable.

*Ben Nevis, August.—Total rainfall, 12·34; greatest fall, 2·39, on 25th; no. rainy days, 24; maximum shade temperature, 53·7 on 4th; minimum ditto, 28·4 on 27th.

Correspondence.

Conchology.—New locality for *Pupa marginata* var. *albina*. Last autumn my friend, Mr. F. Shrive, and I were at Cleve Prior in Worcestershire, when we found the above, together with the type *Pupa marginata* in great abundance. I visited the same locality a few weeks ago, and found the old wall had been replaced by a new one, but still there were plenty of shells to be found. I am indebted to Mr. W. Nelson for naming the shell.—W. H. Boland, Birmingham.

Exposure of the Middle Series of the Bucklandi Beds in Leicestershire.—This sub-zone division of the Lower Lias is now well exposed by the side of the Old Union Canal, near Fleckney, where the beds are worked for brickmaking, etc.; they are also exposed for a short depth by a brook flowing near. The beds, as visible, are covered with drift of about 3ft. in thickness; underlying this come about 20ft. of "soft blue shales, with rows of small limestone nodules in the upper part," and containing larger nodules full of fossils. The fossils seem to lie at a depth of 12ft. to 13ft. from the surface; the shales are full of *Gryphæa arcuata* of large size; four large Nautili have been found, one in possession of Mr. J. Marriott, of Fleckney, being 15 inches in diameter; *Arietites Turneri* is common, of all sizes, varying from ¼ of an inch to 13in. and 17in. in diameter. The following is a complete list of the fossils found:—Vertebræ of Saurian, *Pentacrinus psilonoti*, *Nautilus striatus (?)*, *Arietites Turneri*, *A. conybeari*, *A. semicostatus*, *Belemnites*, *Actæonina sinemuriensis (?)*, *Eucyclus elegans (?)*, *Dentalium etalense*, *Chemnitzia*, *Lima gigantea*, *L. pectinoides*, *Cardinia Listeri*, *Unicardium cardioides*, *Myacites*, *Astarte obsoleta (?)*, *Modiola Hillanoides*, *Ostrea Liassica*, *Gryphæa arcuata*, *Rhynchonella plicatissima*.—H. E. Quilter, Leicester, October 15th.

The Geology of the Midland Counties.—Perhaps there are no better places known in England for studying the palæontology of the Silurian period than Coalbrookdale. In the quarries on Benthall Edge may be found the Cup Corals *(Cyathophyllum)*; *Acervularia Ananas*, a coral resembling the Brain Coral of our present seas; Syringophyllum; Sun Corals (*Heliolites*); Mushroom Corals; Sculptured Encrinites *(Glyptocrinus;)* Chain Corals (*Halysites catenulatus*); Lituites, and remains of Orthoceras. In the "Bone Beds" of Ludlow are found numerous ichthyolites, or fragments of fish remains, as fin-spines, head-plates, and teeth. In the quarries there may be found branched Graptolites, Trilobites, Crinoids, Orthoceras, Pentamerus, and shells of Spirifer. At Ombersley and Bromsgrove, in the rocks belonging to the Triassic system, have been found teeth of gigantic Batrachians. At Bromsgrove is a bed of Equisetaceæ, Calamites, and other flowerless plants. In the hills of Derbyshire we get the Carboniferous system, where, especially at Castleton, may be found Pentacrinus, Actinocrinus, Woodocrinus, Cyathocrinus, Apiocrinus, Trilobites, Producta, Retepora, Ptilopora, Spirifera, Murchisonia, Nautilus, and Orthoceras, in great abundance. At Leamington we have the Lower Lias, where may be found the Giant Lima in profusion, Terebratulæ, *Lima sulcata*, Ammonites, and Belemnites. Between Oxford and Leamington, on the Great Western line, there is a deep cutting through Lias rock, where may be found a variety of horned and simple Ammonites, the Limas, the Gryphæa, and the small oyster of the Oolitic system. At Alderston, in Worcestershire, may be found Pectens in great abundance, and the large bivalve Perna. At Oxford we have the Oolitic system appearing in a sandstone formation called Stonesfield slate, where the remains of the famous Pterodactyle have been found. There may be found Ammonites, Belemnites, Spongia, Pentacrinus, Gryllus, Libellula, Archæoniscus, Unio, Cyrena, Cardium, Trigonia, Ostrea, Gryphæa, Pecten, Nerinæa, Nautilus, and Pleurotomaria. In the limestone caverns of Derbyshire have been found the remains of the hippopotamus, horse, deer, bear, hyæna, and the elephant of our own valleys. I hope that these few remarks will be of some service to my brother Midland geologists.—J. W. Williams, Wesley College, Sheffield.

Ornithological Notes.—*Podiceps cristatus, Picus major, Falco peregrinus, etc.*—About the middle of September a Great Crested Grebe was picked up in a field at Priors' Marston, Warwickshire, about 200 yards from the brook. Although unable to fly, I could not find that it was injured in any way: probably it was exhausted. It proved to be a male bird, in perhaps its second year, as the occipital crest and the ruff were not fully developed. Two specimens of the Great Spotted Woodpecker have been procured in the neighboured this year: the first, an old male, was killed in Farborough Park; the other, in the plumage of the doubtful species, *P. medius*, at Bicester. I hear that two pairs of this bird frequent the first-mentioned locality. On the 10th inst. I saw at the local birdstuffer's a skin of a Peregrine Falcon, which had been received that morning from Byfield, Northants. Whilst in pursuit of some wild ducks on the reservoir there it dashed itself against a telegraph wire, and fell to the ground; a man who saw it picked the bird up and placed it in a cage; he, however, attempted to feed it on "barley meal," and, of course, it died. Swifts were with us for a very long period this season. They arrived early, May 2nd, and stayed unusually late. They generally depart by the middle of August, but this year I noticed them in small numbers and screaming loudly on the 22nd, about a dozen on the 25th, a very few on the 27th, and two on the 30th. No more were seen till September 11th, when we saw a single bird. There were young House Martins in a nest in Banbury, on the 10th inst., a very late date.—Oliver V. Aplin, Banbury, October, 1881.

Gossip.

The Handbuch der Zoologie by Prof. Claus will shortly be published by Messrs. Sonnenschein and Co., the adaptation for English readers being made by Mr. Adam Sedgwick, of Trinity College, Cambridge. Professor Claus has prepared nearly 600 drawings for this edition.

Birmingham Philosophical Society.—The second part of Vol. II. of the Transactions of this Society has just been published, and contains most of the papers read before the members during the Session 1880-1.

The Annual Conversazione of the Birmingham Natural History and Microscopical Society will be held in the Town Hall, Birmingham, on Wednesday evening, November 16th.

Naturalists' Diary.—A correspondent says: "I often wonder that the Editors of the "Midland Naturalist," or some of the London Diary publishers, do not bring out a *Naturalists' Diary.*" If a sufficient number of the readers of this magazine will express their desire to be supplied with such a publication, there shall be no avoidable delay in issuing a really useful one at the lowest possible price. Communications on the subject will be gladly received.

Sir Wyville Thomson, it is announced, will shortly resign the Chair of Natural History in the University of Edinburgh which he has held since 1870.

Ben Nevis.—The recent storm has rendered our esteemed correspondent Mr. C. L. Wragge's hut, on the summit of Ben Nevis, untenantable, and compelled him for the present to discontinue his meteorological observations at that station. The *Athenæum* says: "Besides the obvious necessity of a suitable house on the Ben, Mr. Wragge suggests the connexion of this and other high-level meteorological stations with low-level stations by telegraph or subterranean cables, and directly with the head office in London."

Dr. William Hinds.—We regret to announce the death on October 18th, of Dr. William Hinds, who was the first President of the Birmingham Natural History Association, after its formation in 1858, and who was again elected President in 1870, when it had been reconstituted under its present title, the Birmingham Natural History and Microscopical Society. There was a large attendance of members of the Society, medical men, students from Queen's College, and other friends of the deceased at the funeral, which took place at the Old Cemetery, Birmingham, on October 24th. The late Dr. Hinds lectured on Botany at the Birmingham and Midland Institute from the Session 1859-60 to that of 1874-5.

Mr. Wm. Garneys.—It is with deep regret that we record the sudden death, by apoplexy, on the 21st October, of Mr. Wm. Garneys, M.R.C.S., of Repton. Mr. Garneys was a most devoted student and collector of insects, chiefly of the order *Coleoptera*, and his loss will be greatly felt by all Midland Entomologists.

Scientific Conference.—During the York meeting of the British Association, a conference of delegates from many scientific societies was held in that city with a view to promote the interests of such societies by inducing them to undertake definite scientific work on a uniform plan. Many interesting suggestions were made, and a committee was elected to arrange for the next Conference, who were instructed to send a circular to local scientific societies describing the work of the various committees of the British Association to which they might render aid, and other scientific work which they may usefully undertake.

Herefordshire Pomona.—The fourth part of this magnificent work is now published, price one guinea. Three more parts, completing the book, will be published, one in each of the three next years.

Reports of Societies.

BIRMINGHAM NATURAL HISTORY AND MICROSCOPICAL SOCIETY.—Geological Section—September 27th. Mr. W. J. Harrison in the chair. Mr. J. Bagnall exhibited the following fungi:—*Collybia maculata*, *C. fusipes*, and *Tricholoma nictitans*. Mr. W. J. Harrison showed *Ammonites Humphriesianus* from the Inferior Oolite of Gloucestershire, *A. bifrons* from the Oxford clay, a piece of Solenhofen stone from Germany, and a specimen of Obsidian from Mexico, which latter was described by Mr. T. H. Waller.—Mr. A. H. Atkins exhibited a collection of fossil ferns and other plants from the Coal Measures of Wyre Forest. A short discussion followed on the methods used to distinguish and classify fossil plants.—General Meeting.—October 4th. Mr. Bolton exhibited the Entomostracan, *Polyphemus pediculus*, from Sutton. Mr. Lane exhibited the fungus from a brewer's cask. Mr. Bagnall exhibited *Sphagnum cymbifolium*, *S. auriculatum*, and *S. subsecundum*, from Cut-throat Coppice, Solihull; also, on behalf of Mr. Wilkinson, *Dipsacus pilosus*, from Stafford Castle. Mr. Southall called the attention of the members to an old volume "Abrahamii Muntingii Phytographia Curiosa," published at Amsterdam in 1711. The Secretary then read a paper by Rev. M. J. Berkeley, M.A., on "Underground Fungi," illustrated by enlarged copies of Mr. Berkeley's drawings on the black board. He described the three classes into which subterranean Fungi may be divided, viz., the true truffles, the false truffles, and a peculiar group called Endogone. He also mentioned the conditions under which truffles abound, and the way in which they are found; but warned the local naturalists that, owing to the nature of the soil, there would be little to reward their search in the Midland Counties.—On October 8th the Society made a Fungus foray to Sutton Park, under the guidance of Dr. M. C. Cooke, M.A., the eminent fungologist. The day was one of the worst for the purpose that could be conceived. The previous dry weather and cold nights had produced a scarcity of Fungi, and the rain which fell on the day before had saturated those few which had survived almost past recognition. A cold wind caused the more delicate and less enthusiastic of the party to take the shortest track towards shelter and refreshment, but a devoted band surrounded the leader, bringing him ever new species, and receiving their sounding names from his lips with becoming awe. The "finds" were few; among others a small specimen of the "Beef-steak Fungus," *Fistulina hepatica*, was discovered on an old oak, and several large specimens of the edible *Agaricus nudus*, and of the jelly-like and not-to-be-despised *Tremella foliacea* were found in the woods. No one, however, could muster up courage enough to venture upon them, though several of the party cast longing glances at the delicious morsels. After tea, Dr. Cooke gave the members present some excellent advice on commencing the study of Fungi, which will be found on page 249. October 11th.—Biological Section.—Mr. J. E. Bagnall exhibited plants illustrative of the flora of the Farne Islands—*Festuca rubra*, *Arundo arenaria*, and others; also *Hypnum irriguum* and other mosses from Sutton Park, *Mycena alcalina*, *Pholiota heteroclita*, *Omphalia stellata*, *Cyphella capula*, *Tremella foliacea*, *Peziza aurantia*, and other fungi from the same locality; also on behalf of Dr. J. Fraser, *Frankenia lævis* (Sea Heath) from Sussex, and *Ranunculus parviflorus* (small-flowered Crowfoot) from Cornwall. Mr. Southall exhibited *Boletus luridus*, *B. edulis*, *Amanita aspera*, *A. rubescens*, *Agaricus rutilans*, *A. separatus*, *Paxillus involutus*, *Lepiota excoriata*, *Russula emetica*, *R. heterophylla*, *R. fragilis*, *R. fellea*, *Coprinus atramentarius*, *Ag. asterophorus*, *A. fascicularis*, and *Lactarius subdulcis*, from Yardley Wood. Mr. W. B. Grove exhibited a number of Fungi collected at or near Sutton Park during the Fungus Foray, among which the most remarkable were—*Agaricus chioneus*, a minute species growing on leaves; *A. echinatus* (formerly called *A. hæmatophyllus*, on account of its colour), a most striking species, found but rarely, and generally in hot beds; and *A. udus*, a species first discovered in Britain in November last, in Epping Forest, and now found in similar situations in the damp ground above Bracebridge Pool. Mr. R. W. Chase read a paper on "The Birds of the Farne Islands," a small group off the coast of Northumberland, in which he gave a very interesting account of a visit in May last. The Ornithology of the islands was very graphically described, and the paper was illustrated by a large number of specimens, showing the various changes from the egg to the adult stage of most of the birds. An excellent map and a series of beautiful photographs were also shown, which gave a very vivid idea of the scenery of the locality. The following birds were exhibited:—*Muscicapa atricapilla*, *Certhia familiaris*, *Anthus pratensis*, *A. obscurus* (nest, eggs, and young), *Strepsilas interpres*, *Tringa maritima*, *Somateria mollissima* (nest, eggs, and young in various stages), *Fratercula arctica* (egg and young in various stages), *Graculus carbo* (nest, eggs, and young in various stages), *Sterna dougalli*, *S. cantiaca*, *S. hirundo*, *S. fluviatilis* (eggs and young in various stages), *Larus fuscus* (nest, eggs, and young in various stages). October 18th.—Mr. Levick exhibited a living fresh-water mollusc, *Dreissena polymorpha.* Mr. J. F. Goode exhibited Globigerina and Radiolarian ooze from the bottom of the Atlantic, in illustration of his paper on "Some Deep-sea Challenger Soundings," in the course of which he referred to the change that has taken place in the views formerly entertained as to absence of life from the ocean depths. These are now known to teem with living beings, of which, however, the more lowly organised, such as the Foraminifera, form the greater part. When the sea exceeds a certain depth, its bed is found in almost all parts to be covered with a fine sediment called Globigerina ooze, from the name of the small Foraminifera of the remains of which it chiefly consists. Below 2,500 fathoms this passes into a red clay. There is also found sometimes at intermediate depths, from 2,100 to 2,300 fathoms, a gray clay. At 3,000 fathoms the red clay assumes its most characteristic aspect; below this it becomes altered into Radiolarian ooze, which is called after the organisms of which it is principally composed. Now the Foraminifera are chiefly calcareous, and the Radiolaria siliceous, and all this succession of deposits is explained by the varying action of the sea water, at different depths, upon one and the same deposit. The whole volume of the sea is filled with multitudes of these minute creatures. and their remains are continually falling in a gentle rain upon the bottom—the greatest quantity occurring where the sea is deepest. As the depth increases the deposit becomes more and more disintegrated, the calcareous remains suffering first. Thus the Globigerina ooze passes into the red clay. At the lowest depths the calcareous Foraminifera have altogether disappeared, and the deposit consists mainly of the siliceous tests of the Radiolaria. Mr. Goode also referred to the discovery of a distinct group of minute animals to which the name of Challengerida has been given, and to the at present inexplicable puzzles, the Rhabdospheres and Coccospheres, which are found in the deposit, but of the nature of which naturalists are still doubtful. GEOLOGICAL SECTION.—October 25th. Mr. T. H. Waller, B.A., B.Sc., exhibited a microscopical section of obsidian, cut from a specimen exhibited at a previous meeting. Mr. Abrahall exhibited a fossiliferous pebble from the Isle of Wight. Mr. Wright Wilson showed some thousands of parasitic hydratids from the abdomen of a common fowl which was afterwards sold for food. Mr. W. J. Harrison, F.G.S., gave an interesting account of the rise and progress of the Ordnance Geological Survey of the British Islands. He referred to the differences which had lately arisen between the Government and the officers of the survey with regard to the rate of progress; and Mr. Houghton, M.A., also made some remarks on the same subject. Mr. C. J. Woodward B.Sc., F.G.S., then delivered a brief lecture on "Zones in Crystals," describing how to name and distinguish the planes, their combination in zones, and the application of stereographic projection to crystallography. The lecturer illustrated his remarks by numerous models and experiments.

BIRMINGHAM MICROSCOPISTS' AND NATURALISTS' UNION.—September 5th.—MICROSCOPICAL AND GENERAL MEETING.—Exhibits: Mr. Sanders, larva of Buff-tip Moth; Mr. Boland, land shells from Bearley, also specimen of Convolvulus Hawk Moth, caught in Wales, and *Clausilia Rolphii,* for the first time recorded in Warwickshire; Mr. J. W. Neville, larva of *Bombyx mori,* mounted whole, showing tracheal system complete; Mr Dunn, common Leech, showing young clinging to parents by their suckers. September 12th.—Mr. Darley, cocoon of Emperor Moth, having two outlets side by side in place of the usual one; Mr. J. Baxter, *Cristatella mucedo* and its statoblasts. Mr. C. P. Neville read a paper entitled "A Ramble on the Welsh Hills." September 17th.—Excursion to Knowle and Temple Balsall. September 19.—Mr. Madison exhibited ripple marked slabs from the Keuper Marls, Hatton, also *Estheria minuta,* same locality; Mr. Grew, Ship Barnacle, entire; Mr. Dunn, tentacles of same under the microscope; Mr. J. W. Neville, Puccinia on leaf of violet, Lecythea or rust on leaf of rose, Lecythea and Aregma on leaf of barren strawberry, Cluster Cup and Coleosporum on leaves of coltsfoot. September 26th.—Mr. Boland, Madrepores from Devon; Mr. Darley, *Marvel du jour* Moth. A paper was read by Mr. J. A. Grew on the "Natural History of the Peacock Butterfly." The paper was illustrated by diagrams and a collection of British Vanessidæ.

BIRMINGHAM AND MIDLAND INSTITUTE SCIENTIFIC SOCIETY.—September 28th. Mr. W. B. Grove, B.A., gave an account of some of the more important phenomena connected with "Volcanoes," with special reference to the real source and method of volcanic action. The paper, the writer intimated, was mainly a *résumé* of what is contained in Professor Judd's recent book on the subject. It was pointed out how incorrect were the common ideas connected with volcanoes, and especially the famous governess-dictum, "A burning mountain, from the summit of which issue smoke and flames;" every word of this definition usually is or may be untrue.—October 12th.—Mr. C. B. Caswell gave an account of the properties and uses of Hydrogen peroxide. He described its preparation from Barium dioxide and Hydrogen fluosilicate, and the concentration of the dilute solution so obtained *in vacuo* over strong oil of vitriol, and drew attention to the purity and cheapness of the 10 volume solution now in the market. He then demonstrated the most striking properties of this remarkable body, showing, among other experiments, the mutual decomposition of Hydrogen peroxide and Argentic oxide; the rapid conversion of Plumbic and Ammonic sulphides into their respective sulphates, and the reduction of the Manganic peroxides to the state of protoxide. He also showed the tests whereby the presence of minute traces of this body may be detected; the formation, under suitable conditions, of perchromic acid, a beautiful blue body, being the most characteristic, and the liberation of Iodine from Potassium iodide in presence of Ferrous sulphate being the most delicate. After a description of the estimation of the peroxide by means of standard permanganate in presence of sulphuric acid, the uses to which the solution may be put in the laboratory as an oxidising agent were pointed out, whereby the pungent and noxious fumes to which nitric acid, chlorine, &c., give rise, may be avoided. Mr. Caswell concluded by referring to the recently discovered fact that Hydrogen peroxide is produced in nature on a grand scale during the atmospheric oxidation of oil of turpentine.

BIRMINGHAM PHILOSOPHICAL SOCIETY.—October 12th.—The first meeting of the session was held at the Mason College, the Rev. H. W. Watson, F.R.S. (the President), in the chair.—The Rev. H. W. Crosskey (secretary) read the annual report, which stated that the Council last year had the pleasure of reporting that Dr. George Gore, F.R.S., had accepted the position offered him, and that the amount of £150 per annum had been allotted to him in order that he might have greater facilities for continuing in Birmingham his original researches. Dr. Gore had forwarded a report stating that since he had been entrusted with grants from the Birmingham Endowment of Research Fund, he had made, partly with the aid of those grants, the following researches in physics and chemistry, which had been communicated to the Royal Society, and published, namely:—Thermo-electric behaviour of aqueous solutions with platinum electrodes; influence of Voltaic currents on the diffusion of liquids; experiments on electric osmose; phenomena of the capillary electroscope; electric currents caused by liquid diffusion of osmose; influence of Voltaic currents on diffusion of liquids; and phenomena of the capillary electroscope. He hoped before long to submit to the Philosophical Society an original communication. In addition to the before-mentioned researches, and as an entirely separate matter, he had been aiding the cause of original research by preparing for publication a small book on "The Scientific Basis of National Progress," and it was now being printed. The Council have further had the pleasure of granting the sum of £20 to Dr. C. A. McMunn, of Wolverhampton, to enable him to obtain the apparatus needed for the continuance of his original researches on the "Spectroscopy of Animal Colouring Matters." The Council believed that the meetings of the society would be made more interesting if various notes were presented in addition to the papers which might be read. They invited the members, therefore, to bring forward notes of any special research in which they might be engaged, as well as to furnish more elaborate papers. In reviewing the history of the society since its foundation, the Council had every ground for believing in its future. It had made steady progress, and the two volumes of its Proceedings already published showed the value of the work that had been done.—Mr. George Hookham (treasurer) read the financial statement, and announced that £1,080 had been received in donations and £90 paid in annual subscriptions to the Birmingham Endowment of Research Fund.—Mr. Lawson Tait moved the adoption of the report and statement of accounts.—Dr. Simon seconded the motion, which was unanimously carried.—Dr. Heslop moved the re-election of Mr. Watson as president for the ensuing year.—Mr. William Mathews, M.A., seconded the resolution, which was carried.—Mr. Mathews and Dr. Norris were elected vice-presidents; the Rev. H. W. Crosskey, F.G.S., and Mr. R. Levett, M.A., secretaries; and Mr. George Hookham, M.A., treasurer.—The President then delivered his address, which dealt with the subject of "The Progress of Positive Science, and the Duties of Society in relation thereto." The crowning triumph, he said, of physical discovery was the science of energy, the revelation of a new entity, indestructible like matter, and the source and storehouse of all physical activity. He was tempted to linger on that theme not only on account of its importance, but because this science had been in a great degree the work of British physicists, mainly of the Cambridge school. Fifty years ago the idea of general physical conservation of energy was absolutely non-existent, though the mechanical conservation of energy had been clearly enough stated. This conception had little less than revolutionised science. There was no branch of physics which had not felt its influence. Electricity, magnetism, and chemistry had alike contributed fresh evidence to its truth and acknowledged its directing power. Physical treatises of no remote date had been in a great measure rendered obsolete. The conservation of energy and the doctrine of development were pre-eminent amongst the many instances of progress—the one bringing a whole province of investigation within the domain of scientific treatment, and the other supplying a real and potent bond of union between sciences hitherto thought independent. Dealing with the second portion of his subject, Mr. Watson observed that scientific advance was disquieting to some people from its supposed antagonism to their religious convictions. Theology, however, need fear no enmity where morality had found so sure a friend. Science had no creed, and was of no theological colour. Some eminent scientific men did appear to lose sight of this truth, and to regard themselves as the emissaries of a destructive mission. The true vocation of the scientific man was the single minded pursuit and the fearless assertion of positive truth, unbiassed by a foregone conclusion. Doubtless there might be found among the clergy, as amongst the laity, people to whom the line from Dryden might be applied—"The priest continues what the nurse began." But there was no greater intolerance in those persons than in the conduct of men who became emissaries of a materialistic or atheistic creed. The true position of science in this respect was every day becoming more fully recognised. The president went on to deal with the distrust which some people had towards scientific pursuits, because they thought those pursuits were unpractical, and tended to distract their votaries from the real business of life. Lastly, he mentioned some of the methods by which local organisations such as this society, established for the promotion of exact and accurate scientific research, were able to forward the good cause.—Mr. Levett moved a vote of thanks to the president for his address, which was seconded by Dr. Tilden, F.R.S., who said he should endeavour to induce his colleagues in Mason College to bring forward original contributions at the meetings of the society.—The President having acknowledged the compliment, the meeting terminated.

CHELTENHAM NATURAL SCIENCE SOCIETY.—October 20th.—After the transaction of the routine business Mr. H. Matthews read a paper on the "Storage of Electricity," which was illustrated by experiments.

NOTTINGHAM WORKING MEN'S NATURALISTS' SOCIETY.—This society held its monthly exhibition on October 3rd, when Mr. J. Hazard exhibited two specimens of the "Snow Bunting" (*Plectrophanes nivalis*), and one specimen of the "Little Ringed Dotterel" (*Charadrius minor*), shot at Gedling, Notts. Two specimens of the "Tiger Moth," viz., a black and a white variety, were exhibited by Mr. T. Goldsmith. Mr. Watchorn exhibited a specimen of the "Clouded Yellow" (*Colias edusa*), captured at Newstead, Notts, July, 1881. Mr. W. Gough exhibited some specimens of fungi, in which the Agaric family figured prominently.

NORTHAMPTON NATURAL HISTORY SOCIETY.—Exhibits at inaugural meeting, October 18th: microscopes; Messrs Durham and Kempson, *Lophopus crystallinus* and *Stentor polymorphus*; Mr. Dangerfield, circulation of sap in *Vallisneria spiralis;* Mr. Osborne, spiracle of beetle *(Dytiscus marginalis)*, tongue of wasp, &c.; Mr. J. Gregory, microscopic moths and microfungi. Mr. Tomalin, jun., exhibited his entomological captures of the past summer, amongst which were:—

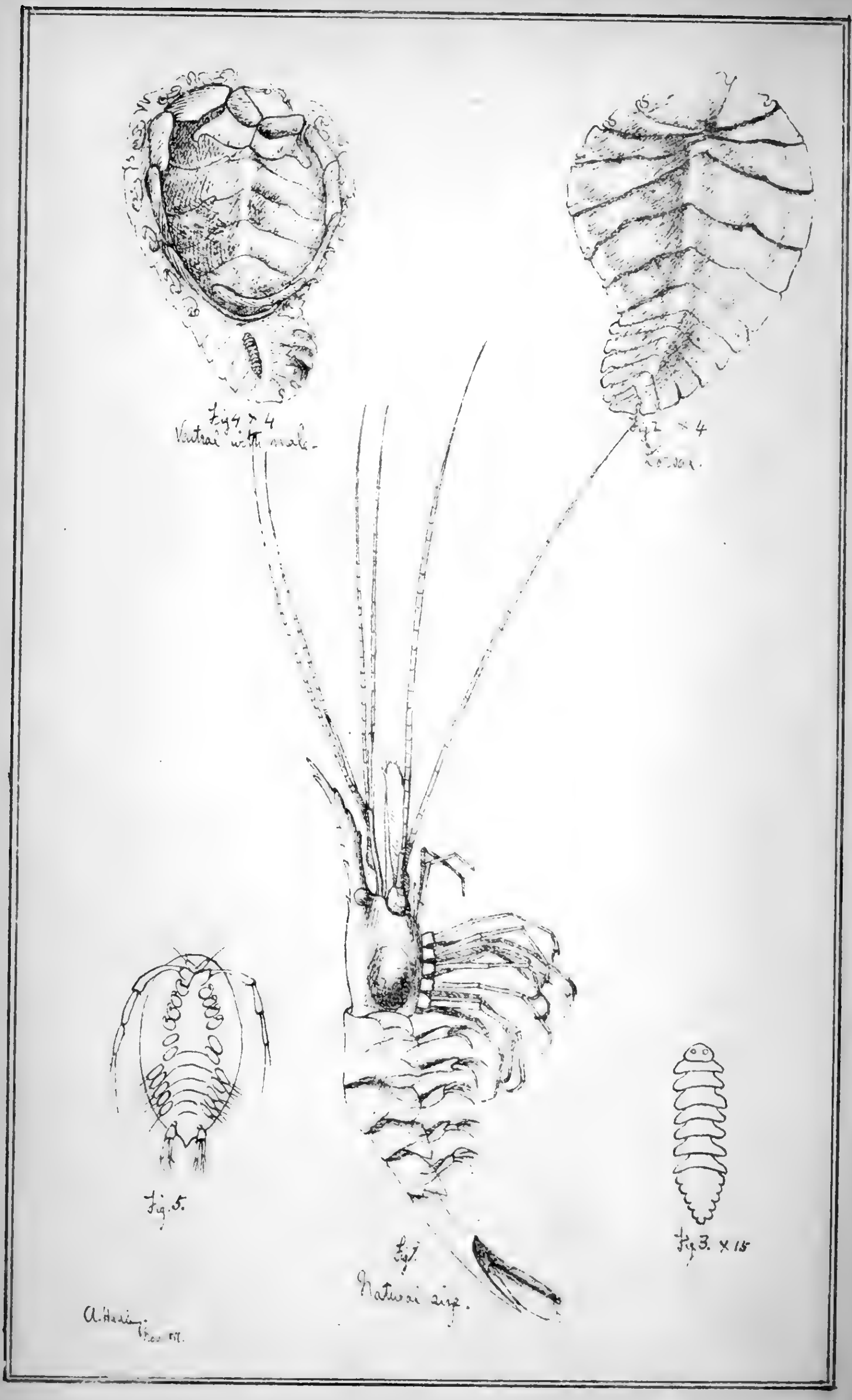
Macroglossa stellatarum	Humming-bird Hawk.
Sphinx convolvuli	Convolvulus Hawk.

(Four specimens have been caught in this neighbourhood this year in the first week of September).

Anthrocera filipendulæ	Six-Spot Burnet.
Calligenia miniata	Rosy Footman.
Orgyia pudibunda	Pale Tussock.
Cossus ligniperda	Goat Moth.
Zeuzera æsculi	Wood Leopard.
Platypteryx unguicula	Barred Hook-tip.
Dicranura vinula	Puss Moth.
Nonagria fulva	Small Wainscot.
Nonagria typhæ	Bulrush Moth.
Hydræcia nictitans	Golden Ear.
Luperina testacea	Lesser Flounced Rustic.
Apamea unanimis	Uniform Rustic.
Grammesia trilinea	Treble Lines.
Anchocelis rufina	Flounced Rustic.
Cirrædia xerampelina	Centre-barred Sallow.
Dicycla oo	Scalloped-wing Oak Moth.
Polia chi	Chi Moth.
Aplecta herbida	Green Arches.
Amphipyra pyramidea	Copper Underwing.
Pericallia syringaria	Lilac Beauty.
Ennomos tiliaria	Canary-shouldered Thorn.
Biston prodromaria	Oak Beauty.
Boarmia consortaria	Pale ditto.
Eubolia cervinaria	Mallow.
Tephrosia punctularia	Engrailed.
Melanippe tristata	Small Argent and sable.
Abraxas ulmata	Scarce Magpie.
Halias quercana	Scarce Silver lines.
Chesias spartiata	Streak Moth.

OSWESTRY AND WELSHPOOL NATURALISTS' FIELD AND ARCHÆOLOGICAL SOCIETY.—The last excursion for 1881 was made on Monday, September 26th. Meeting at Longville Station, near Wenlock, the party first walked to the "Ditches," a well-marked ancient fortification on the hill above Lutwyche Hall, the seat of Mr. Benson. On their way they visited a quarry on Wenlock Edge, and found several of the fossils which abound in the Wenlock Shale. "The Ditches" is a circular space about 200 yards in diameter, and enclosed by earthwork ramparts, of which there are traces of three, or perhaps four. The party then proceeded to Cardington, and visited the church, to which there is a Norman doorway, and a timber porch dated 1639. In the church there is the tomb of Judge Leighton, who died in 1607. The oldest bell bears the date 1603, and another, 1742, bears the inscription, "Fear God, honour the King." The party then ascended Caer Caradoc, a hill of some 1,400 feet, of volcanic origin. From its top there is a fine view of Shropshire and the neighbouring counties, extending as far as Wolverhampton, the Malvern Hills, and the Brecon Beacon. Taking the train at Church Stretton, the members and their friends returned home after a very pleasant day. The following plants rewarded the botanists: *Gentiana campestris, Chlora perfoliata, Tragopogon pratensis,* and *Colchicum autumnale.*

PLATE X.



Bopyrus Squillarum.

NOTES ON BOPYRUS SQUILLARUM.
A PARASITIC CRUSTACEAN.*

BY W. R. HUGHES, F.L.S.

In looking over a collection of miscellaneous marine specimens, the proceeds of many a pleasant dredging excursion, which had accumulated during several years, with the view to find some worthy of the museum of this noble college, I found one—the subject of these notes—which I took at Torquay in 1867, and which, as I do not remember to have seen it exhibited here previously, I think may occupy our attention for a few minutes before it follows the example of its fellows. *Bopyrus squillarum* is a small parasitic crustacean, of pear-like shape, which selects for its habitat a position beneath the front shield or carapace of the common edible prawn, *Palæmon serratus*, and some other allied forms, the presence of the female causing a large tumour of nearly half an inch in diameter on the side where the parasite affixes itself (Fig. 1), the tumour being largest when the parasite is distended with ova. *Bopyrus* belongs to the second of the two great divisions into which the Crustacea have usually been separated—the sessile-eyed, that is to say those whose eyes are not placed upon footstalks, the other division being termed the stalk-eyed. It is of the order Isopoda (equal feet), in which the legs are adapted for walking only, first named by Latreille, and so founded in contradistinction to the order Amphipoda (both feet), the members of which have both swimming and walking feet.

The family of the Bopyridæ, which includes *Bopyrus squillarum*, is small, numbering only four genera, but according to Messrs. Spence Bate and Westwood, the historians of "The British Sessile-Eyed Crustacea," "it exhibits some of the most remarkable modifications of structure amongst its different members, whilst the characters of the group render it a very distinct one amongst the families of which the order is composed." Limiting for the present a comparison of this singular organism with a high type of the crustacea—say its host *Palæmon serratus*, the common prawn—we shall be able to gain a conception of the remarkable modifications which *Bopyrus* has undergone, if we assume, according to the laws of evolution, that they have both originated from a common progenitor.

Description of Plate X.

Fig. 1 gives the Prawn and its parasites *in situ*; Fig. 2 gives a dorsal view of the female parasite; Fig. 3 gives a dorsal view of the male parasite; Fig. 4 gives the nauplius stage of the parasite; and Fig. 5 gives the male parasite in the folds of the pleon of the female. Figs. 1, 2, and 5 are sketched from preserved specimens. Figs. 3 and 4 are copied from "The British Sessile-Eyed Crustacea," by Messrs. Spence Bate and Westwood.—I am greatly indebted to Miss Hadley for making the illustrations.—W. R. H.

* Read before the Birmingham Natural History and Microscopical Society, at the Mason College, on Tuesday, 31st May, 1881.

The appearance of the ordinary edible prawn is familiar to all, and its elegant and vivacious movements in the Aquarium have delighted and amused thousands of observers, to say nothing of its gastronomic qualifications, which appear to have been appreciated, if not entirely understood, in Shakespeare's time, for Hostess Quickly says to Falstaff in the Second part of King Henry IV., "Did not goodwife Keetch, the butcher's wife, come in then and call me Gossip Quickly? coming in to borrow a mess of vinegar; telling me she had a good dish of prawns; whereby thou didst desire to eat some; whereby I told thee they were ill for a green wound?"

Without going too much into technical details it is sufficient to say that the prawn consists anteriorly of a chitinous shield or carapace, from which extends a rostrum armed with seven or eight teeth. The animal has three pairs of antennæ—the external ones being very long—half as long again as the animal itself from the tail to the extremity of the rostrum. The eyes are large, round, and projecting. It has five pairs of thoracic feet, two of which are furnished with chelæ or nippers for prehension, the second pair being much the larger and stronger. Beneath these are the jaws (maxillipedes) and a wonderful alimentary apparatus for food crushing and filtering, which has been minutely described by Professor Huxley in an allied form in his magnificent monograph "The Crayfish." The remaining three pairs of feet are devoted to purposes of walking. These limbs carry eight respiratory gills (podobranchiæ) attached to the basal joint, and placed under cover of the carapace. Posteriorly the prawn has six movable abdominal segments (or somites), the last one (or telson) terminating in a triangular joint, to which are attached on either side two laminæ furnished with hairs, forming the tail. These segments carry anteriorly five pairs of swimmerets, "which are used like paddles when the animal swims quickly." The ova find lodgment on these limbs. As is very well known, the prawn and its congeners are subject to periodic moults. Notwithstanding its comparatively small size and slender figure it would, I think, be difficult to conceive an animal better adapted by the shapes and positions of its organs to fulfil its functions—the delicate, long, and sensitive antennæ used as organs of touch, and perhaps of smell, the prominent compound eyes with a wide range of vision, the strong-toothed rostrum projecting from the stout carapace for poking about for food in the crevices and crannies of rocks, the nimble hands for seizing it, the graceful and active walking and swimming feet, the muscular segmented body and tail adapted for darting through the water and enabling the prawn when in full health to evade, perhaps, most of its enemies, except man with his prowling "shrimp net." The organism is greatly but not completely in harmony with the environment. And from the fact that it delights in a habitat between tide marks, it has acquired, as any observer may have noticed in watching the movements of prawns frequenting rock pools, an intelligence and boldness that must aid it in "the struggle for existence." Many littoral marine animals of high type, as crustaceans and fishes, frequenting a varying environment, appear to have acquired a superiority of intelligence over those confined to deep water where the conditions of life remain unchanged.

In the "Principles of Biology," and in that division of it which treats of the morphological development and of the general shapes of animals, Mr. Herbert Spencer has pointed out, *inter alia*, that the structure of decapodous crustaceans, as represented by the prawn, exhibits an advance in structure over the isopodous crustaceans, and a marked advance over such creatures as the centipede and *julus* types, any one of which latter animals (all the segments being nearly uniform) may be bisected transversely into parts differing very slightly from each other; but if cut in two horizontally the under and upper halves are decidedly unlike, whereas the head and tail of the prawn show a very marked contrast and an advance in structure over the other segments. Of bilateral symmetry, and in comparative harmony with the environment, the incidence of forces being equal, the common prawn exhibits a striking contrast to *Bopyrus* as will hereafter appear. Doubtless "the sum of the vital activities" of the prawn, as Mr. Herbert Spencer would express it, is much greater in any given interval than that of many members of its own class, and greater even than animals of higher type, such as the oyster and others, which lead sedentary lives.

In *Bopyrus*, what first strikes one as being noticeable is an absence of the symmetrical arrangement of *Palæmon*, which characterises the female *Bopyrus*, giving a strange lop-sided appearance to it (Fig. 2), although the male (Fig. 3), being free, is symmetrical. From the peculiar position of the female in the carapace of the prawn the incidence of forces is unequal. Next is the disparity of size between the sexes, the female being about five times longer than the male, which is only one line in length. This rule obtains sometimes in the *Insecta*, but not markedly so in the higher *Crustacea*. The female of *Bopyrus* is broad and ovate, while the male is elongated. Further, the segments of the body of the female appear but faintly, those of the male on the contrary being well marked and distinct. The head (cephalon) is almost immersed in the body of the female, but is better developed in the male, the eyes appearing distinct. The antennæ in both sexes are very short and rudimentary, and so is the mouth, which, according to Spence Bate and Westwood appears to lose much of its normal character, and as one would expect from the parasitic nature of *Bopyrus*, fulfils the office of a sucking apparatus. The seven pairs of legs are almost of equal size, strong and thick, and furnished with a well-developed broad hand, strongly hooked for prehension. The tail (pleon) is well marked in both sexes. The females are furnished with large incubatory plates. Not only in *Bopyrus*, but throughout the curiously degraded family of the Bopyridæ, the branchial organs "are depauperated to the lowest degree," being little more than excrescences on the under side margins of the tail. Beneath the plates covering these the male is usually found. Fig. 4 exhibits the male *in situ*. The colour of the female *Bopyrus* is pale green, and the body is not of strong consistence. The young *Bopyri* are of an oval form, somewhat like a wood louse, with the outer pair of antennæ greatly elongated, carrying slender setæ. The legs are sub-chelate, and the tail carries two pairs of joints, terminating in setæ. It appears that in the nauplius or larval condition (Fig. 5), the young exhibit the most advanced stage of development; according to Spence Bate and Westwood, "the organs of sense and motion being proportionately larger and better developed at that period of their existence than ever after." Messrs. Spence Bate and Westwood further say: "It would thus appear as if the nervous energy was then greater, and that the growth of males and females is but what Dr. James D. Dana calls a vegetative process, and one that is destructive of cephalisation, which decreases in proportion to the growth of the animal. They therefore argue that of the adult *Bopyri* the smaller male ought to be taken as typical of the species rather than the more abnormal female." I particularly direct your attention to the fact of high development in the nauplius stage as a most remarkable illustration of that special branch of modern biological speculation termed phylogeny, which professes "that the development of any organism should furnish the key to its ancestral history."* It would appear from this that *Bopyrus* is derived from some more perfect form of crustacean, and that its degraded organs in the female in maturity are due to its peculiar environment within the carapace of the prawn. The *Bopyri* seem to gain access to the body first by sheltering in the early stage among the freely hanging ova of the prawn. They work in pairs, as appears from a communication to the Proc. Zool. Soc., November 24, 1863, afterwards finding their way into the carapace, and so, as the authors I have quoted say, "having quitted the care of their own parent they are fostered by another on whom probably at a later period they prey parasitically." As with most parasites the fecundity of these creatures is considerable, no fewer than 800 young being nourished in the incubatory pouch of the female. Most of these perish, for only one mature parasite and its mate infest their host at one time.

The existence of *Bopyrus* has been known for some time, but not properly understood; for in the year 1772 Mons. de Bondaroy, a French naturalist, published a memoir on *Bopyrus squillarum* disproving the old fallacy entertained by fishermen on the coasts of France that *Bopyri* were the young of soles or other flat fish, which took shelter under the shell of the prawn to protect them in their early stages of growth—an idea held even by some scientific men at that period. In the year 1837 Rathke made some interesting observations upon *Bopyrus*, showing from an examination of a number of specimens that

* Huxley, "Manual of Invertebrata." Introduction, page 41.

they usually infested the *female* prawn only, for out of several hundreds infested the male prawn was free.

Dr. Fritz Müller made, in the year 1864, a very remarkable observation on a member of the *Bopyridæ*, which he communicated to the authors of the " British Sessile-Eyed Crustacea." He says : " One of the most interesting animals of this family is a *Bopyrus* living on *Pagurus* (a genus of the hermit crab), in which the dorsal surface of the parasite is directed towards the *Pagurus*. (He therefore named it *Bopyrus resupinatus*.)" The origin of this curious mode of attachment is the following :—The larva of *Bopyrus* affixes itself to *Sacculina purpurea* (another parasite of the non-segmented suctorial order of crustaceans *(Rhizocephala)* living on the same *Pagurus*), and takes its nourishment from the roots of the parasite. After the death of the *Sacculina*, to whose central surface the *Bopyrus* was fixed, the latter probably cannot change its position, and remains with its dorsal surface facing the *Pagurus*.

Finally, in briefly contrasting together the two adult animals, the host *Palæmon* and its parasite *Bopyrus*, we have the symmetrical, compact, segmented body of the one, and the unsymmetrical body of loose consistence of the other—the cephalothorax with its stout rostrum and compound eyes gives place to a mere extension of the body of the other—the complicated mouth of the one is represented by a mere sucking apparatus in the other—the long and sensitive antennæ of the one are represented by merely dwarfed extensions in the other ; the ramifying branchiæ of the one give place to rudimentary organs in the other ; the long, slender, and graceful walking and swimming feet of the one are represented by dwarfed limbs in the other; but, as a compensation, and the only one of the greatest importance to the parasite, the hands are both strong and numerous to aid it in grasping and holding on.

If I have at all succeeded in enabling the members to gain a conception of the relative differences, not only between the typical crustacean as host and its particular parasite under consideration, but also between the different stages of growth of that parasite, I think they will agree with me that no better illustration could be adduced of "the effects of use and disuse of parts," and of the " adaptation of the organism to its environment." As Mr. Herbert Spencer has pointed out in the " Principles of Biology " before referred to, animals of the Annulose type become unsymmetrical when their parts are unsymmetrically related to the environment. The common hermit crab *(Pagurus)* furnishes an illustration like *Bopyrus*. The embryos of each of these creatures are symmetrical, but the curvature of the body of the hermit crab is due to the position it acquires to adapt itself to the shell which it inhabits, and the unsymmetrical condition of the adult *Bopyrus* is similarly due to the position it occupies within the carapace of its host the prawn. Except for the writings of Dr. Darwin and Mr. Herbert Spencer such biological problems as that presented in the morphology and degraded structure of *Bopyrus* would be totally inexplicable. Thanks, however, to the light thrown on these questions, especially by the illustrious author of "The Origin of Species," a new significance is apparent, and as he has shown in that wonderful work, "any change in function which can be effected by insensibly small steps is within the power of natural selection; so that an organ rendered, during changed habits of life, useless or injurious for one purpose, might be modified and used for another purpose." And again: "Rudimentary organs may be compared with the letters of a word, still retained in the spelling, but become useless in the pronunciation, but which serve as a clue in seeking for its derivation."*

Bopyrus, so far as the female is concerned, is apparently getting worsted in the struggle for existence. One cannot help thinking that in the distant future its lease of life will not be remarkably long. So much the better for the prawn!

BIRMINGHAM NATURAL HISTORY AND MICROSCOPICAL SOCIETY.

ANNUAL CONVERSAZIONE.

The Annual Conversazione of this Society was held on November 16th, at the Town Hall, Birmingham. It was a great success, not only in regard to the number of the visitors, but also to the character and extent of the display. The class of objects which was admitted differed from that comprised in former exhibitions of the kind in being more closely restricted to the Natural History and Microscopy which form the legitimate bounds of the Society's exertions. The only exceptions to this restriction were the admission of a few objects coming under the head of Archæology and Art, which, while interesting in themselves, were not sufficiently obtrusive to spoil the effect of the whole. Now that it has been demonstrated that an amount of material, capable of affording instruction and entertainment to a large assembly for more than three hours, can be gathered together without trespassing upon ground which more properly belongs to other societies, it is to be hoped that the course thus marked out will be followed on future occasions. The exclamations of delight which could be heard on every side, as some fair damsel saw for the first time those beautiful creatures, living and moving, which she had heretofore met with only in the dry pages of her school text-books; or as some Birmingham manufacturer, who had devoted his life-time to the ledger and the desk, took his first glance into a realm of glory of even the very existence of which he had before no conception; the crowds which surrounded the favourite exhibits, as, for instance, that which made taking one's turn for a peep at the Amœba as hard a task as

* "Origin of Species," pp. 52, 40. *Fourth Edition.*

waiting for the opening of the doors at a concert where some queen of song was to delight the audience with her thrilling notes;—these things showed how great a desire existed to know some of the secrets of nature; and yet how many there are to whom, even in these days, these secrets are as a closed book. It is one of the highest privileges which a Natural History Society possesses, that of being able to add to the enjoyment as well as to the instruction of those whose powers of investigating nature are undeveloped.

Before entering upon a description of the principal exhibits, it may be premised that the microscopical display, which occupied the floor of the hall, and upon which the chief energies of the Society were as usual concentrated, was arranged by Mr. A. W. Wills upon a plan which made it something more than a mere series of pretty objects. The series was so formed that the visitor was led through the whole of the animal and vegetable kingdoms by gradually ascending steps, beginning in each case with the most lowly organisms. That the series was not perfect must be admitted, but everyone who has exhibited living microscopic creatures knows how perversely the very organisms which he wants refuse to turn up at the required moment. One word of general praise must not be forgotten. Those who had been familiar with previous exhibitions of the kind remarked an obvious improvement in the average degree of skill with which the objects under the microscopes were illuminated.

Among the microscopical exhibits only a selection can be made. By far the most interesting, at least to the members of the Society, were the illustrations of the structure of the very rare Funiculina, Virgularia, and Pennatula, which had been obtained during the Marine Excursion to Oban last July. The entire animals were also exhibited. These were shown by Messrs. W. P. Marshall and C. T. Parsons. Mr. W. R. Hughes exhibited living specimens of Terebratula and Caryophyllea (a coral), also dredged at Oban. Messrs. Hughes, Collins, Potts, Allport, and Goode exhibited a series of specimens, prepared by Mr. F. W. Sharpus (who was the first English observer of the fact), demonstrating the viviparous nature of the Brittle Starfish (*Ophiocoma neglecta*). Mr. Wagstaff exhibited living specimens of *Spongilla fluviatilis;* and Mr. J. Levick, the large Amœba, *Lithamœba discus* (Ray Lankester), and *Brachionus urceolaris.* Mr. A. W. Wills exhibited living Desmids from Sutton Park; and Mr. G. E. Davis, the curious fungus, Myxotrichum, which produces mildew in cotton goods. Besides these there were many others, the total number of microscopes being between seventy and eighty.

At a separate table was exhibited, by Mr. F. Enock, a collection of microscopical preparations of insects of all orders, mounted with pressure, retaining the chitinous skin only; also a collection of heads of insects and entire insects, mounted without pressure, and retaining their natural form and colour. These are especially valuable because the absence of distortion enables the student to make out all the parts and their uses with accuracy and ease.

Mr. G. E. Davis exhibited Abbe's Apertometer, and his own Limiting Diaphragm for reducing the apertures of high angle objectives. Mr. W. Cotterell exhibited a collection of crystals; Mr. F. A. Walton, minerals and crystals; Mr. W. J. Harrison, rocks, minerals, and crystals; and the Committee of the Birmingham Water Department, antlers and bones of deer found about 9ft. below the surface, in digging the Shustoke Reservoir.

Mr. J. E. Bagnall, who on a previous occasion had exhibited all the grasses of Warwickshire, now showed a complete series of the British Grasses, including *Hierochloe borealis*, collected by Robert Dick, the Thurso naturalist. Mr. T. Bolton exhibited a collection of sea-weeds; Mr. W. Southall photographs of American medicinal plants, and a pharmaceutical herbarium, also a splendid group of the edible fungus, *Clitocybe nebularis*. Mr. W. B. Grove exhibited a large collection of Fungi from Sutton Park, including the rare *Chamæota echinata*, and the edible species *Clitocybe nebularis* and *Pleurotus ostreatus*.

Mr. F. Felton exhibited birds' eggs from the neighbourhood of Birmingham; Professor T. W. Bridge, on behalf of the Mason College, various specimens of animal life; Mr. F. A. Walton, a collection of insects, and cases of birds; Mr. G. S. Tye, fine collections of British Crustacea and American Unionidæ, the latter showing the remarkable tendency to variation, which has, in one instance, enabled book-naturalists to manufacture and append their names to more than one hundred and fifty species out of the different forms of one.

The chief taxidermists of the town showed cases of birds, but the great feature of the ornithological display—second, indeed, in interest only to the microscopes—was the fine collection of British Birds exhibited by Mr. R. W. Chase. These were exquisitely mounted, the surroundings being in most cases an exact copy of the actual place in which the birds were found. One of the finest was a group of the Auk family, on a piece of chalk cliff. The collection was also made more valuable by presenting in many cases the nest and eggs, and the various stages of growth from the young to the adult.

LIST OF SPECIES EXHIBITED BY MR. R. W. CHASE.

Aquila chrysaëtus ..	Golden Eagle ..	Stornoway.
Haliaëtus albicilla ..	White-tailed Eagle ..	Ditto.
Pandion haliaëtus ..	Osprey	Staffordshire.
Falco peregrinus ..	Peregrine Falcon ..	Olton.
,, æsalon	Merlin	Bromsgrove.
Milvus ictinus ..	Kite	Bourne, Lincolnshire.
Pernis apivorus ..	Honey Buzzard ..	Sussex.
Lanius excubitor ..	Great Grey Shrike ..	Wylde Green and Brighton.
,, collurio ..	Red-backed Shrike ..	Sutton Coldfield.
,, rutilus ..	Woodchat Shrike ..	Yorkshire.
Panurus biarmicus ..	Bearded Titmouse ..	Cambridge.

Ampelis garrulus ..	Waxwing	Aston Park about 1845.
Motacilla yarrelli ..	Pied Wagtail	Hants.
,, alba ..	White Wagtail ..	Brighton.
,, boarula ..	Grey Wagtail ..	Nechells.
,, flava ..	Grey-headed Wagtail.	Brighton.
,, raii ..	Yellow Wagtail ..	Sussex.
Alauda alpestris ..	Shore Lark	Shoreham.
Plectrophanes lapponicus	Lapland Bunting ..	Brighton.
Loxia curvirostra ..	Crossbill	AstonPark, about 1845.
Pyrrhocorax graculus	Chough	Isle of Man.
Œdicnemus crepitans.	Great Plover	
Charadrius pluvialis..	Golden Plover ..	Harwich.
Squatarola helvetica..	Grey Plover	Shoreham.
Vanellus cristatus ..	Lapwing	Sutton Coldfield.
Ægialitis hiaticula ..	Ringed Plover ..	Perthshire.
Strepsilas interpres ..	Turnstone	Stockton-on-Tees.
Recurvirostra avocetta.	Avocet	Stornoway.
Totanus calidris ..	Redshank	Perthshire.
Tringa canutus ..	Knot	Shoreham.
,, subarquata ..	Curlew Sandpiper ..	Littlehampton.
,, maritima ..	Purple Sandpiper ..	
,, alpina ..	Dunlin	Hants.
,, Temminckii ..	Temminck's Stint ..	Shoreham.
,, minuta ..	Little Stint	,,
Calidris arenaria ..	Sanderling	Harwich.
Phalaropus fulicarius.	Grey Phalarope ..	Bourne.
Limosa lapponica ..	Bar-tailed Godwit ..	Harwich.
,, agocephala ..	Black-tailed Godwit..	Lincolnshire.
Numenius arquata ..	Curlew	Perthshire.
Ardea cinerea ..	Heron	Hants.
,, garzetta ..	Little Egret	Near Scarborough.
Botaurus stellaris ..	Bittern	Lincolnshire.
Rallus aquaticus ..	Water Rail	Hants.
Crex pratensis ..	Land Rail	Water Orton.
,, porzana ..	Spotted Crake ..	Bromford.
Gallinula chloropus ..	Moorhen	Washwood Heath.
Anser albifrons ..	White-fronted Goose..	
,, leucopsis ..	Bernicle Goose ..	
Anas strepera ..	Gadwall	Norfolk.
,, clypeata ..	Shoveller	Ireland.
,, acuta ..	Pintail Duck ..	Lincolnshire.
Harelda glacialis ..	Long-tailed Duck ..	Sutherlandshire.
Œdemia fusca ..	Velvet Scoter ..	,,
Œdemia nigra ..	Common Scoter ..	
Somateria mollissima	Eider Duck	Farne Islands.
Mergus albellus ..	Smew	Selly Oak.
,, serrator ..	Red-breasted Merganser	Stornoway.

Colymbus glacialis ..	Great Northern Diver	Filey.
,, arcticus ..	Black-throated Diver	Stornoway.
,, septentrionalis	Red-throated Diver ..	,,
Fratercula arctica ..	Puffin	Farne Islands.
Alca torda ..	Razorbill	Flamborough Head.
Uria troile ..	Guillemot	Bass Rock.
,, grylle ..	Black Guillemot ..	Isle of Man.
Phalacrocorax carbo..	Cormorant	Tenby.
,, cristatus	Shag	Isle of Man.
Sula bassana ..	Gannet	Bass Rock.
Sterna fluviatilis ..	Common Tern ..	Farne Islands.
,, hirundo ..	Arctic Tern	,,
,, dougallii ..	Roseate Tern ..	,,
,, cantiaca ..	Sandwich Tern ..	,,
Larus tridactylus ..	Kittiwake Gull ..	Worcestershire.
,, glaucus ..	Glaucous Gull ..	Bridlington.
,, leucopterus ..	Iceland Gull	Near Brighton.
,, marinus ..	Gt. Black-backed Gull	Hants.
Lestris parasiticus ..	Richardson's Skua ..	Filey.
,, longicaudus ..	Buffon's Skua ..	Lichfield.
,, pomatorhinus	Pomatorine Skua ..	Leicestershire.

Among the objects of Art and Archæology Mr. W. Bragge exhibited a collection of 125 Russo-Greek "Icons," or religious pictures; Dr. Hill Norris, Zulu war implements; Mr. F. A. Walton, a case of Indian arrow-heads; Mr. W. H. Vernon, portfolios of sketches; Mr. W. Willis, albums containing admirable reproductions of his delicately-beautiful pencil drawings; and Mr. H. Miller, two rubbings of Brasses from Felbrigg Church, near Cromer, Norfolk.

In conclusion, we must not omit to record that the success of the Conversazione was mainly due to the untiring exertions of the Secretary, Mr. John Morley.

OUR SUMMER MIGRANTS.

AVERAGE DATES OF ARRIVAL AS NOTICED IN THE NEIGHBOURHOOD OF BURTON-ON-TRENT.

BY H. G. TOMLINSON.

The following notes as to the average dates of arrival of some of our summer migrants may be an interesting comparison with Mr. Macaulay's Birds of Leicestershire, which appeared in your November Number. Those with an asterisk prefixed will be found to differ as to date of arrival from Mr. Macaulay's notes of same species.

1. The Chiffchaff, common in neighbourhood of tall trees. I once heard one on March 9th, 1869; average date, March 25th.
2. *Blackcap Warbler, common in gardens and woods; April 18th to 30th.
3. Willow Wren, common; Aprill 4th.
4. Wheatear, very rare.
5. Swallow, very common; April 13th.

6. Martin, very common; April 13th to 20th.
7.*Sand Martin, very common; generally seen the end of March, never later than April 5th.
8.*The Swift, very common; once seen in April, always by May 6th; leaves in August, once seen in September.
9. Wryneck, not noticed in this locality.
10. Garden Warbler, rare; April 20th.
11. Whitethroat, common; end of April.
12. Lesser Whitethroat, common; April 14th.
13.*Yellow Wagtail, very common; often seen the end of March.
14. Nightingale, occasionally visits us end of April or early May.
15. Cuckoo, end of April. I heard one this year on August 8th at 11 p.m. in my garden. Was it a young or old one?
16. Grasshopper Warbler, rare; first week in May, often found in osier beds. May be seen if closely watched.
17 Sedge Warbler, very common; end of April.
18. Redstart, rare; end of April.
19. Tree Pipit, common; 18th of April.
20. Wood Wren, nowhere common, but met with in all large woods and parks; first week in May.
21. Winchat, common; first week in May.
22. Spotted Flycatcher, common; last week in May.
23. Pied Flycatcher, not found here.
24.*Landrail, common; always heard by May 1st in Trent meadows or osier beds.
25. Nightjar, rarely found.
26. Red-backed Shrike, rarely found.
27. Turtle Dove; end of April, rather rare.
28. White Wagtail, very rare.
29. Reed Warbler; end of May. I have always several pairs build in my garden in privets and lilacs. They are late breeders, never nesting till middle of June. Common in osier beds and gardens near the river. The Cuckoo frequently lays in the nests of this bird.
30. Ring Ouzel, not found here.
31. Quail, very rare.
32. Sandpiper, rather rare; but seen in May and June on Trent and Dove.

METEOROLOGY OF THE MIDLANDS.

THE WEATHER OF OCTOBER, 1881.

BY CLEMENT L. WRAGGE, F.R.G.S., F.M.S., ETC.

October was marked by great atmospheric disturbance, and in this is found the chief meteorological feature of the month. During the first six days pressure continued uniformly high, but on the seventh the barometer gave way, and a great and broad depression (with temporary and trifling recoveries), evidently covering a wide area of our zone, spread over these latitudes. The succeeding crest was not reached until the 16th. Contained as it were in the rear of this *main* disturbance was the extraordinarily deep cyclonic trough of the 13th—14th, with the resulting hurricane that did such immense damage throughout the British Islands. My space entirely forbids more than a very brief notice of this remarkable storm. It appears to have originated "about 150 miles south of Nova Scotia on October 10th," and thus its centre occupied barely four days in travelling across the Atlantic to the coast of Great Britain, a distance of 2,440

STATION.	OBSERVER.	RAINFALL. Total for M.	Greatest fall in 24 hours.		No. of rainy d.	TEMPERATURE. Greatest ht.		Greatest cd.	
		In.	In.	Date.		Deg	Date.	Deg	Date.
OUTPOST STATIONS.									
Ben Nevis *(a)**	C. L. Wragge, Esq., F.M.S.	6·58	3·11	10		51·1	7	18·4	13 to 17
Fort William *(a)**	C. L. Wragge, Esq., F.M.S	4·31	1·39	10	11	62·2	1	30·1	16
Spital Cemetery, Carlisle	I. Cartmell, Esq.	2·02	1·02	13	9	68·8	2	17·7	31
Scarborough *(a)*	F. Shaw, Esq., F.M.S.	3·98	0·59	13	21	60·8	11	33·5	31
Blackpool *(a)*—North Shore	C T. Ward, Esq., F.M.S.					60·9		30·6	
South Shore		2·73	1·31	13	13	59·7	2	25·7	30
Llandudno *(a)*	J. Nicol, Esq., M.D., F.M.S.	2·42	·28	7	13	60·0	1	30·6	30
Boston	W. H. Wheeler, Esq.	2·54			18	58·0	11	31·0	17
Lowestoft *(a)*	H. E. Miller, Esq.	3·25	·79	13	20	59·7	11	32·3	17
Carmarthen *(a)*	G. J. Hearder, Esq., M.D.	5·44	1·58	13	15	63·7	1	26·5	31
Altarnun, Cornwall	Rev. J. Power, M.A.	4·35	·93	22	13	64·0	1	20·0	30
Sidmouth *(a)*	W. T. Radford, Esq., M.D.	2·04	·33	22	13	61·6	11	29·8	31
Ventnor *(a)*	H. Sagar, Esq.	1·60	·59	22	11	61·9	23	31·6	31
St. Augustine's, Ramsgate *(a)*	Rev J. C. Swanson, O.S.B.	5·27	·90	8	20	61·5	11	33·5	31
MIDLAND STATIONS									
GLOUCESTERSHIRE.									
Stroud	S. J. Coley, Esq.	1·46	·54	23	8	62·0	1	24·0	31
Cheltenham *(a)*	R. Tyrer, Esq., F.M.S.	2·05	·75	13	16	60·6	1,11	21·5	31
WILTSHIRE.									
Marlborough *(a)*	Rev. T. H. Preston, F.M.S.	1·26	·42	22	12	60·3	1	21·3	31
SHROPSHIRE.									
Woolstaston	Rev. E. D. Carr	2·82	1·13	13	15	60·0	3		
Stokesay	M. D. La Touche	2·58	·81	13	16	65·0	9	22·3	31
Bishop's Castle	E. Griffiths, Esq.	3·62	1·23	13	15	62·0	1	24·0	31
More Rectory, Bishop's Castle	Rev. A. S. Male	3·45	1·08	22	17	60·0	1,2	26·0	17,30
Dowles, near Bewdley	J. M. Downing, Esq.	2·48	1·16	14	9	72·0	8	18·0	17
HEREFORDSHIRE.									
Burghill *(a)*	T. A. Chapman, Esq., M.D.	1·92	·61	22	13	61·1	11	23·9	31
Stoke Bliss	Rev. G. Alexander	2·71	1·00	22	16	60·0	1,3,11	28·0	29,30
WORCESTERSHIRE.									
Orleton, Tenbury	T. H. Davis, Esq., F.M.S.	3·00	·99	13	19	62·5	1,11	24·0	17
West Malvern	A. H. Hartland, Esq.	2·58	1·00	22	13	60·5	3	27·5	29
Evesham	T. J. Slatter, Esq., F.G.S.	1·80	·77	13	13	60·5	11	26·0	31
Pedmore	E. R. Marten, Esq.	2·79	1·10	13	14	68·0	4	25·0	29
Stourbridge	Mr. I. Jefferies	2·31	·97	13	14	62·0	11	27·0	30
Cawney Bank, Dudley	Mr. C. Beale	2·69	·87	13	16	59·0	1	28·0	29
STAFFORDSHIRE.									
Dennis, Stourbridge *(a)*	C. Webb, Esq.	2·48	·87	13	13	61·0	1,2,11	25·0	16
Kinver	Rev. W. H. Bolton	2·25	·91	13	16	61·0	11	25·0	16
Walsall	N. E. Best, Esq.	3·59	1·06	13	17	63·0	10	28·0	29
Lichfield	J. P. Roberts, Esq.	3·20	·80	13	10	65·0	1	25·0	17
Grammar School, Burton	C. U. Tripp, Esq., M.A.	3·10	·96	13	21	62·0	1,2,11	25·0	17,18
Weston-under-Lyziard	Hon. & Rev. J. Bridgeman	2·75	·78	13	15	61·0	11	26·0	30,31
Wrottesley *(a)*	E. Simpson, Esq.	2·51	·91	13	13	61·3	1	25·7	30
Heath House, near Cheadle *(a)*	J. C. Philips, Esq., J.P.	3·5[illegible]	1·00	13	12	59·0	2,3	28·7	16
Beacon Stoop, Weaver Hills *(a)*	Mr. James Hall	2·32	·53	13	12	53·9	11	26·3	30
Alstonfield	Rev. W. H. Purchas	3·28	1·34	13	15	67·5	2	21·2	17
WARWICKSHIRE.									
St. Mary's College, Oscott *(a)*	J. MacElmail, Esq.	2·90	·81	13	11	61·8	2	28·4	30
Henley-in-Arden	T. H. G. Newton, Esq.	2·76	·97	13	18	64·0	1	25·0	17,18
Kenilworth *(a)*	F. Slade, Esq., C.E., F.M.S.	2·66	·92	13	21	60·6	11	24·4	17
Coundon, Coventry	Lieut.-Col. R. Caldicott	3·25	·90	13	18	58·0	1	29·0	16
Rugby School	Rev. T. N. Hutchinson	3·07	·95	13	19	62·0	2	27·6	16
DERBYSHIRE.									
Stony Middleton	Rev. U. Smith	5·13	1·44	13	14	58·0	1,2	25·0	29,30
Fernslope, Belper	F. J. Jackson, Esq.	4·08	·98	13	17	59·0	2	26·0	17
Spondon	J. T. Barber, Esq.	3·70	1·08	13	15	58·0		24·0	30
Duffield	W. Bland, Esq.	3·71	1·06	13	11				
NOTTINGHAMSHIRE.									
Mansfield *(a)*	W. Tyrer, Esq., F.M.S.	3·10	·64	13	20	59·5	2	28·6	17
Park Hill, Nottingham	H. F. Johnson, Esq.	3·25	·88	13	17	60·4	1	30·0	1
Hodsock Priory, Worksop *(a)*	H. Mellish, Esq., F.M.S.	2·33	·80	13	19	61·4	1	25·8	17
Tuxford	J. N. Dufty, Esq., F.G.S.	2·61	·66	13	18	57·0	11	28·0	16,31
LEICESTERSHIRE.									
Loughborough *(a)*	W. Berridge, Esq., F.M.S.	2·92	1·11	13	19	65·1	2	26·6	17
Syston	J. Hames, Esq.	2·49	1·12	13	20	67·0	1	26·0	17
Town Museum, Leicester	J. C. Smith, Esq.	2·91	1·01	13	16	62·3	2	31·2	31
Ashby Magna	Rev. Canon Willes	2·79	·87	13	18	59·0	1,2		
Kibworth	T. Macaulay, Esq.	3·15	·99	13	16	56·0	2	28·0	16
Waltham-le-Wold	Edwin Ball, Esq.	3·47	1·16	14	16	58·0	5	28·0	17
Dalby Hall	G. Jones, Esq.	2·69	·85	13	18	61·0	1,11	25·0	16,30
Coston Rectory, Melton *(a)*	Rev. A. M. Rendell	3·14	1·04	13	15	59·0	11	23·5	17
NORTHAMPTONSHIRE.									
Towcester	J. Webb, Esq.	3·07	·86	22	14				
Castle Ashby	R. G. Scriven, Esq.	2·88	·87	13	11	61·0	11	30·0	17
Kettering	J. Wallis, Esq.	3·34	1·08	13	16	59·0	12,13	29·0	17
Althorp	C. S. Groom, Esq.	3·18	1·01	13	20	58·0	1	23·0	16
OXFORDSHIRE.									
Radcliffe Observatory, Oxford	The Staff	1·80	·54	13	9	63·4	1	25·6	31
BEDFORDSHIRE.									
Aspley Guise, Woburn *(a)*	E. E. Dymond, Esq., F.M.S.	2·38	·67	13	14	59·9	2	26·4	31
RUTLAND.									
Northfields, Stamford	W. H. Hayes, Esq.	2·74	1·03	13	16	60·0	4	25·0	17
Uppingham *(a)*	Rev. G. H. Mullins, F.M.S.	3·41	1·17	13	19	62·7	2	30·2	30

(a) At these Stations Stevenson's Thermometer Screen is in use, and the values may be regarded as strictly intercomparable.

* The Ben Nevis and Fort William observations are for 27 days only; the mountain observatory has been since closed for the winter.

The synopsis for October from my station in the Churnet Valley, at Oakamoor, will appear at foot in next number.—C. L. W.

nautical miles. It came up from W.S.W., and was strictly cyclonic in character, giving north-easterly gales on its north-west side in Scotland, and south-westerly on its south-east side in central England, the wind veering and backing respectively as the storm centre passed over towards north-east. Immense damage was done, chiefly to timber, throughout the Midlands; and at Burton-on-Trent no such disastrous gale can be remembered. Between the 19th and 26th another wide *main* depression covered the British Isles, accompanied by fresh gales. The month was cold on the whole, temperature being 3½ degrees below the average at Orleton and Henley-in-Arden. Duration of sunshine at Hodsock, 107.0 hours. Mean sea temperature at Scarborough, 50.6.

Correspondence.

NATURALISTS' DIARY—(p. 266).—The proposed diary will not be issued for next year, the number of applications for it being insufficient to justify its publication.

STORMY PETREL.—We lately had a visit from a Stormy Petrel, but it did not live long after its capture. It has been mounted, and is now in the possession of Mr. Robert Drane, F.L.S., a chemist in the town.—W. ADAMS, Cardiff.

ÆGIALITIS CURONICUS (GMELIN) LITTLE RINGED PLOVER.—In the report of the meeting of the Nottingham Working Mens' Naturalists' Society, held on October 3rd, published in the "Midland Naturalist" for this month (p. 271), it is stated that there was exhibited "one specimen of the Little Ringed Plover (*Charadrius minor*), shot at Gelding, Notts." Mr. Harting in his valuable "Handbook of British Birds" (1872), records less than a score of specimens of this little bird as having been killed in Great Britain. I have not seen the Nottinghamshire bird recorded elsewhere, and I am sure Ornithologists would feel obliged to Mr. Hazard if he would kindly publish further particulars of this interesting occurrence.—OLIVER V. APLIN, Banbury, Oxon, November, 1681.

ALPINE CHOUGH.—On the supposed occurrence of the Alpine Chough in a wild state near Banbury, Oxon.:—In the June number of the "Midland Naturalist" (p. 139), I recorded what I then believed to be a specimen of the Cornish Chough, *Pyrrhocorax Graculus* (Linnæus), remarking that it appeared to be immature, the legs being orange and the bill yellow, and that the latter seemed unusually short. On reading the note at a meeting of the Natural History Society here, I stated that I was not sure that the bird was not of a much rarer species, and to my record of it in the "Zoologist" the Editor appended a note that it was "possibly an Alpine Chough escaped from confinement." I can now state that from an examination of a specimen in the Oxford museum, and a reference to the plate in Mr. Dresser's work on the "Birds of Europe," my suspicions are confirmed, and I have little doubt that the bird killed in Broughton Park in April last is the Alpine species *Pyrrhocorax alpinus*, Koch.—a bird which has not, I believe, hitherto been recorded in a truly wild state in Great Britain. With regard to the present specimen having escaped from captivity, I may say that the plumage was clean, and not rubbed in the least, nor did the food found in the stomach (cf. p. 139,) point to its having been caged at any very recent period. Possibly though, it was an escaped bird, and had been at liberty long enough to lose the marks of confinement.—OLIVER V. APLIN, Banbury, Oxon., November, 1881.

Reports of Societies.

BIRMINGHAM NATURAL HISTORY AND MICROSCOPICAL SOCIETY.—November 1st—GENERAL MEETING.—Mr. Bagnall exhibited *Scirpus acicularis* and *Gymnostomum tenue* from Olton Reservoir, which is a new Warwickshire station for these plants; also, *Peplis portula* and some fungi from the same locality. Mr. W. B. Grove exhibited *Craterium minutum*, *Trametes inodora*, *Polyporus betulinus*, *Hygrophorus virgineus* (an edible species), *Helotium citrinum* and other fungi. Mr. Blatch exhibited *Elater balteatus*, a beetle found for the first time in Sutton Park during the Fungus Foray, and *Endomychus coccineus*, a beetle new to Warwickshire; also, on behalf of Mr. J. Levick, *Elater oculatus* (living,) a species found in North America. Mr. A. W. Wills presented to the Society fourteen slides of Desmidieæ, mounted by himself and including many rare and new species. Mr. W. R. Hughes, F.L.S., presented for the cabinet of the Society, on behalf of Mr. F. W. Sharpus, of London, one of the corresponding members, a series of twelve slides, prepared by the donor, illustrating the structure and functions of certain members of the class *Echinodermata* (Star-Fishes, Sea-Urchins, etc.) They consisted of four slides demonstrating the viviparous nature of *Ophiocoma neglecta*, one of the brittle-stars. Mr. Sharpus, who was the first English observer who noticed this remarkable phenomenon, communicated the fact to this Society some years ago. Four slides exhibiting the structure and dental apparatus of *Ophiocoma rosula* (another of the brittle-stars); one slide exhibiting the renewal of a lost ray in an extremely young specimen of *Uraster rubens* (the common Cross-Fish), about one-third of an inch in diameter; and two slides showing the structure of certain curious and interesting pincer-like organs, probably modified spines, of the Star-Fish (*Uraster glacialis*), and of the Sea-Urchin (*Echinus sphæra*), termed *Pedicellariæ*, the functions of which have long been an unsolved problem to Zoologists, who are not even now quite agreed as to their exact nature. In submitting the preparations, Mr. Hughes glanced at the position of the *Echinodermata* as a class, and particularly at the two methods of reproduction, one by means of a "pseudembryo," and the other "viviparously," as noticed by Mr. Sharpus, supplemented in some instances, as was shown in the *Challenger* expedition by means of a "Marsupium." He also described the preparations at length, which are extremely beautiful, the method of mounting which Mr. Sharpus has by long experience as an amateur perfected, and which has already been described in the "Midland Naturalist," Vol. II., p. 126. The preparations were further illustrated by drawings made by Mr. W. P. Marshall and Mr. A. W. Wills. Mr. Levick superintended the microscopical exhibition. A cordial vote of thanks was passed to Mr. Sharpus for his kind and valuable present. November 8th—BIOLOGICAL SECTION.—Mr. J. E. Bagnall exhibited *Fontinalis antipyretica*, from Rugby Canal; *Hypnum fluitans*, var. *submersum*, from near Gaydon, a new record for the county; *Chenopodium hybridum*, from near Stratford-on-Avon; *Triticum repens*, abnormal form having a compound branched spike, from Alveston Heath. Mr. T. Bolton exhibited *Nymphon gracile*, living, *Pycnogonum littorale*, living, and showing the circulation of the blood; also, *Eolis Landsburgii*, Doris, Hydrozoa and Polyzoa from Bangor. Mr. W. B. Grove exhibited *Craterium minutum*, a fungus belonging to the order Myxomycetes, showing the elaters by which the spores are dispersed; also section of *Nectria cinnabarina*, showing at the same time the conidio-spores and the asco-spores. Professor T. W. Bridge, read a paper on "The Auditory and Vocal Organs of Fishes," in which he referred more particularly to some siluroid fishes in which the auditory, vocal, and tactile organs are most highly specialised. The paper was illustrated with numerous diagrams and specimens. November 16th—ANNUAL CONVERSAZIONE at the Town Hall (see page 278). November 22nd—GENERAL MEETING.—Mr. T. Bolton exhibited *Pandorina Morum*, and *Synchæta pectinata*. Mr. W. B. Grove exhibited two of the Myxomycetes, *Trichia varia* and *Chondrioderma difforme*, also a young specimen of *Agaricus disseminatus*, showing the spores *in situ* on the gills, and *A. cerussatus* and *Tremella albida*. Mr. H. Miller exhibited the Sapucaya nut of Brazil. Mr. Silvanus Wilkins then read a paper "On a Dragon-Fly," in which he devoted attention chiefly to the facts which could be observed by quiet watching, without capturing the insect. He spoke of the curious way in which the male dragon-fly captures his mate, and compared it to the savage mode of carrying off a bride by force, humorously suggesting that the two habits were connected by the theory of descent. Mr. Kenrick made some observations on the huge eye of the dragon-fly, and, by comparing its forward position to that of the eyes of hawks and predaceous beetles, illustrated his argument that upon this depends the power which they possess of keeping their prey in view when they are close upon it as easily as when it is at a distance. By this means they are enabled to turn sharply in pursuit, as however close they may be they can see it with both eyes, and thus possess the advantage of binocular vision. Mr. Blatch also made some remarks on the food of the dragon-fly, and pointed out how Mr. Wilkins's paper illustrated the fallacy of the allegation that the Midlands are but a barren hunting ground for the naturalist. November 29th—GEOLOGICAL SECTION.—Mr. J. Levick described a number of original Photographic Views of "Scenes in India," which were exhibited by Mr. C. Pumphrey with the aid of the oxyhydrogen lantern. The series contained about one hundred fine and effective views, including the principal buildings and scenery of Calcutta, Agra, Lucknow, Benares, Ceylon, and the Himalayas. The views and descriptions were much appreciated by a large and attentive audience.

BIRMINGHAM MICROSCOPISTS' AND NATURALISTS' UNION.—October 2nd.—A meeting, at which were exhibited by Mr. Wykes, backbone of turtle; by Mr. Boland, vertebræ of Ichthyosaurus and scales of Lepidotus, from the Lias, Bearley; by Mr. J. W. Neville, larva of B. mori, showing two rows of hooklets in each leg; and by Mr. H. Insley, section of chalk pebble from drift beds, Leicester, showing foraminifera *in situ*. October 10th.—A paper by Mr. Blay, "Our Common Bog Plants," illustrated by specimens. October 17th.—Exhibited by Mr. Madison, *Terebratula caput-serpentis*, from Oban; by Mr. J. W. Neville, tongue of water spider; by Mr. Wykes, section of sheep's horn and cow's hoof by polarised light. October 24.—Mr. Baxter showed resting spores of *Volvox globator*; Mr. Wykes, *Chelifer muscorum*; Mr. J. W. Neville, double eyes of *Gyrinus natator*. November 1st and 2nd.—The second annual conversazione. The exhibits included foreign insects, fine calc-spar, quartz, and other crystals, and flint implements from North America, by Mr. Walton; British Lepidoptera and Reptiles, by Mr. F. Shrive; complete collection of British land and fresh-water shells; foreign beetles and skull of Ichthyosaurus, by Mr. Boland; land shells, eocene fossils, and various skulls, by Mr. Madison; British birds' eggs, by Mr. Searle; collection of birds, by Mr. Betteridge; British insects, by Mr. J. A. Grew; 150 slides of insects of the district, prepared for the microscope, by Mr. J. W. Neville; circulation of blood in frog's foot, cyclosis in Nitella, Lophopus crystallinus by Mr. J. Baxter; collection of district plants and various botanic microscopic objects, by Mr. Blay. Messrs. J. Wykes, Moore, and C. P. Neville exhibited various polariscope objects; Messrs. Bradbury, Flowers, and Parker, miscellaneous microscopic objects; Mr. H. Insley, fossils from Wenlock limestone, (Walsall); South Staffordshire Coal Fields; oolite of Gloucestershire and Red Crag (coast of Essex). The coal plants were illustrated in the following microscopical sections:—Longitudinal section of Stigmaria; transverse section of *Rachiopteris Oldhamia*, a fern found in the Oldham coalfields; various sections of outer scale of Lepidodendron; a section and set of rocks illustrating the structure of Pouk Hill, near Walsall, was also shown. November 14th.—Annual meeting.

BIRMINGHAM SCHOOL NATURAL HISTORY SOCIETY.—Meetings of this Society have been held as under:—GENERAL MEETING.—October 19th. A paper was read by R. Moore, on "Autumn Wild Flowers." Several rare and interesting dried specimens were exhibited. ZOOLOGICAL SECTION.—November 2nd. A paper was read by H. T. Roberts on "Fishes." GENERAL MEETING.—November 11th.—An exhibition of specimens was held at this meeting. Belcher exhibited a collection of dried specimens of wild flowers.

A. B. Badger exhibited some Stentors under the microscope. ZOOLOGICAL SECTION.—November 16th. A paper was read by F. Pearson, on "Bees."

BANBURYSHIRE NATURAL HISTORY SOCIETY. — November 7th. Mr. T. Beesley, F.C.S., president, in the chair. Exhibits: *Bacteria*, from the air of a pigstye (microscopic slides); Larva of one of the "Hoverer" Flies (*Helophilus*), commonly called Rat-tailed Grub, and microscopic rock sections by Mr. Beesley; Flint Implements (Arrow-heads, etc.) from Oxford and Ireland by the Secretary (Mr. E. A. Walford); some live Amphibians, *Rana esculenta*, *Bombinator igneus* and *Salamandra maculosa*, from Switzerland; and Land and Fresh-water Tortoises. *Testudo* and *Emys*, by Mr. O. V. Aplin; Barnacles, *Lepas anatifera*, and wood bored by the Shipworm, *Teredo norvegica*, by Mr. Symington; Skeleton and Skins of *Talpa europœa*, also Mole Trap, and a specimen of the Mole Cricket *Gryllotalpa vulgaris*, from Broughton, by Mr. W. Wyatt: section of Coal Shaft, Monkwearmouth, by Mr. E. West. The President read the meteorological report for October, stating that the mean temperature was 44·8 degrees, nearly five degrees below the average. Mean height of barometer, 29·634 inches. Rainfall on nineteen days, 2·47 inches; greatest fall (13th), 0·77 inch. Snow fell on the 29th. High winds on the 14th, 15th, 20th, and 22nd. Very strong wind on the night of the 13th, and all the 14th it blew a perfect hurricane, and did much damage to property in the neighbourhood. It caused more than one fatal accident through the falling of trees and branches. Mr. O. V. Aplin read notes on some Amphibians and Tortoises, exhibited on the table. Mr. W. Wyatt read an interesting paper on the Mole, *Talpa europœa*, giving a description of the anatomy of the animal, and an account of its fortress, habits, etc. He also called attention to the Mole Cricket, which also tunnels in the ground, and pointed out the curious resemblance which exists in the structure, and a corresponding resemblance in the habits of the two creatures, although the one has an internal and the other an external skeleton. The President read an important paper on "Bacteria, and their supposed connection with disease." Bacteria, minute bodies capable of endless and exceedingly rapid reproduction, and which are Algæ, were stated to exist almost everywhere, in the soil as well as in the air, drought only suspending their vitality, bright light causing them to die or become dormant, but moisture aiding their increase. Very strong evidence had been brought forward showing that some of the more formidable contagious diseases were produced by the introduction of these organisms into the blood. He showed that he had collected them from the air of a pigstye, one of the forms being identified as the germ of "malignant carbuncle" occurring in oxen, pigs, etc., a small dose of which, he believed, had produced carbuncle in man. Mr. Aplin also read a note on "The Supposed Occurrence of the Alpine Chough, (*Pyrrhocorax alpinus*, Koch,) in a wild state, near Banbury.

BURTON-ON-TRENT NATURAL HISTORY SOCIETY.—The first evening meeting of the season was held on Friday, November 4th, Mr. R. Thornewill, President of the Society, in the chair. Mr. W. G. Davy (Hon. Sec. Tamworth Nat. Hist., Geological, and Antiquarian Society) read an interesting paper on "Personal Reminiscences of a Tour in Iceland." Mr. Davy illustrated his route by means of a map, and had on the table for exhibition some photographs of the places visited, and of pieces of wood carving done by the natives. Articles of attire, pieces of exquisitely worked gold and silver jewellery, some curious relics, domestic utensils, and geological specimens were also exhibited. A vote of thanks was given to Mr. Davy. Mr. Davy, in reply, said he was glad to assist the Society, or any other similar society. He advocated an interchange of work and papers among the different societies in the Midland Union of Natural History Societies.

ERRATA.—In the list of moths on page 272, *Tephrosia punctularia* should be *T. biundularia*. In November number, page 258, line 6, "Rock Salt (pseudomorphs), Aust, *Igneous rock*," should be "Keuper and Rhætic."